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VIEWS, NEWS AND INTERVIEWS.

"Did you ever think what an inefficient piece of apparatus a passenger elevator is?" queried Meekin, the lazy inventor, as he lit his pipe and sighed contentedly, a sure indication that he was about to unravel a yarn. "I mean in this way: The elevator, as we know it, is like the Irish hod carrier who was commiserated by a passing philanthropist.

"'You poor man!' said the philanthropist. 'Do you have to climb up that ladder all day long?'

"'Faith an' Oi don't, sorr. Half the toime Oi cloimb down,' answered Pat.

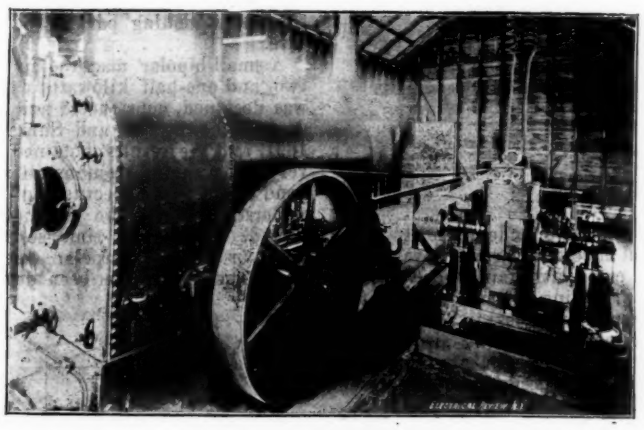
"Now that's just the way with an elevator—half the time carrying a load up and half the time carrying it down. It occurred to me a few years since that here was a chance for a neat exhibition of my inventive abilities. I secured the use of a vacant warehouse and installed an electric elevator—one of the first ever used, by the way. My elevator, though, instead of having only one passenger car, was just covered all over with 'em; nothing else but passenger cars, in fact. It was like a coal conveyor, one of those endless chain arrangements with little buckets on it about a foot apart. My arrangement was like this: An endless pair of cables passed over a big pulley at the top of the building and down around the electric driving mechanism in the basement. Every six feet was a little platform for a man to stand on and at a convenient height was a brass rod for him to hold on to. The endless cable was kept revolving, and the idea was for a man to step on a platform on the first floor, ride up to the height he desired and then skip off. When he wanted to come down, he walked around to the other side of the elevator shaft and reversed the process, by stepping on and riding down. Well, she worked all right experimentally, and I decided to give an exhibition. I hired a lot of tramps to do the riding. The crowd assembled, I set the machine going, and then lined up my tramps, who were instructed to step on, a man at a time, as fast as the platforms came by the first floor. It worked all right till I had about 10 men aboard, when the fellow who was highest up thought he'd get off at the third floor. He tried to, but wasn't quick enough. He stepped off on the floor, got rattled, and then tried to step back on the platform, which in the mean time had been going up. Instead of stepping on the platform he stepped on the neck of the man below him. This jammed the cable chute, threw an overload on the motor, which blew a fuse and stopped. Pretty soon the load of tramps all on one side started the whole thing to reversing. Finally, a yelling, tangled mass of tramps began to pour out of the elevator door on the first floor, and every time a platform would go by it would bang some fellow and he'd let out an extra yell. I had to shut down at this point and square myself with the tramps, who began to demonstrate that they didn't love me as they should."

In the Metropolitan Hotel, New York city, about 15 years ago, a set of 17 crystal chandeliers was placed in the banquet hall. They were imported from Europe at an expense of $25,000, and were regarded as the finest examples of crystal work in this country. The large central chandelier had 48 lights. Last week the furnishings of the hotel, including the chandeliers, were sold. Oscar Hammerstein, the well-known theatrical man, bought the large chandelier for $900. He also bought the remainder of the set, paying $2,630 for them, but handling and transportation will add nearly $2,000 to the bill. Mr. Hammerstein said that he intended to have the chandeliers remodeled for electrical use and put up in his new up-town music hall.

Thieves recently got away with 600 feet of heavy copper return wire which they stole from between the tracks of the Point Defiance, Tacoma & Edison Railway at Tacoma, Wash. The rails were not stolen, and the trolley poles are still standing.

"Telephone linemen, in the days of overhead wires, used to ruin lots of tin roofs," said an old-time exchange manager. "In walking across a tin roof the lineman's spurs would jab a hole in the tin at nearly every step. It got so in Kansas City at one time that not a business man in town would let a telephone lineman go up on the roof unless he took off his spurs and left them in the office."

It is probable that arc electric lights will be placed in Watkins Glen, N.Y., the coming season.



INTERIOR VIEW OF AN AUSTRALIAN ELECTRIC LIGHT STATION, 12,500 FEET ABOVE THE SEA.

THE MOST ELEVATED ELECTRIC LIGHT STATION IN THE ANTIPODES.

TWELVE THOUSAND FIVE HUNDRED FEET ABOVE THE SEA.

The illustration on this page, which is made from a photograph supplied by a correspondent of the ELECTRICAL REVIEW, shows the interior of an electric light plant located in the Australian mountains at an altitude of 12,500 feet above the sea level.

The plant supplies current for lighting the Braemar Sanitarium at Woodend, State of Victoria, Australia.

The dynamo is a Crompton continuous current 110-volt machine, delivering 109 amperes at 1,180 revolutions of the armature per minute.

The engine is a Robey high-pressure double-cylinder. The cylinders are eight inches in diameter, and the engine uses steam at 85 pounds pressure, running at 110 revolutions per minute.

The Search-Light at the Atlanta Exposition.

A feature in the electrical display at the Cotton States and International Exposition to be held at Atlanta, Ga., from September 18 to December 31, 1895, will be the immense battle-ship search-light, which will be placed by the Naval Department on the highest dome of the Government building. From this point, which will be the highest on the exposition grounds, the immense search-light will be operated every night, throwing its brilliant shaft of light into all parts of the grounds. So brilliant will be the light that a newspaper can be read by it miles away, and the weird and marvelous scenic effects that will be produced as it shifts like a phantom from point to point, lighting up domes and cupolas, can be likened only to a dream from the Arabian Nights.

The Fremont, Neb., Gas and Electric Light Company is endeavoring by legal steps to prevent the city of Fremont from letting contracts for the construction of a municipal electric light plant.

A METHOD FOR PREVENTING ARMATURE REACTION.

READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK AND CHICAGO, MARCH 20, 1895, BY HARRIS J. RYAN AND MILTON E. THOMPSON.

In the designing of continuous current dynamo machinery, probably nothing has presented so much difficulty as the problem of avoiding the

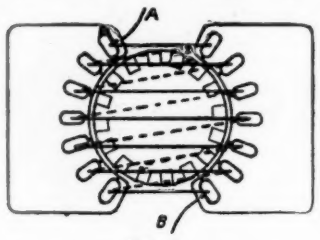


FIG. 1.

various evils resulting from the magnetic effects of the current that passes through the armature of the machine. Such magnetic effects are usually spoken of as armature reaction. These evils are at the present time well known and pretty well understood by the electrical fraternity in general, and the modern dynamo designer who is not thoroughly well posted on the subject would be

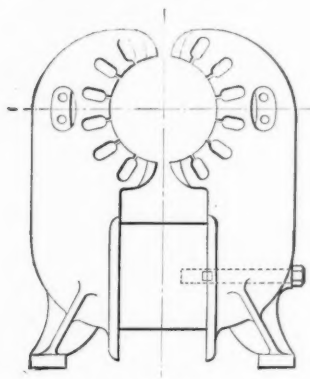


FIG. 2.

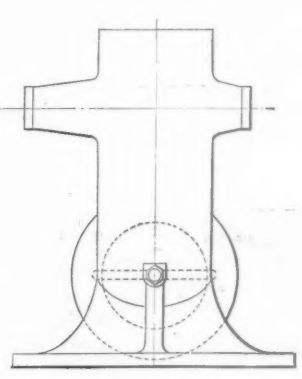


FIG. 3.

wholly unable to design machinery capable of successful competition with some of the machines now on the market. The tendency of the currents that circulate in the armature coils is to produce a cross magnetism through the core at right angles to the natural field, resulting in a distortion of the natural field of the dynamo, a piling up of the magnetic lines under the trailing pole corners and a weakening of the field under the leading pole corners. This distortion, of course, increases with

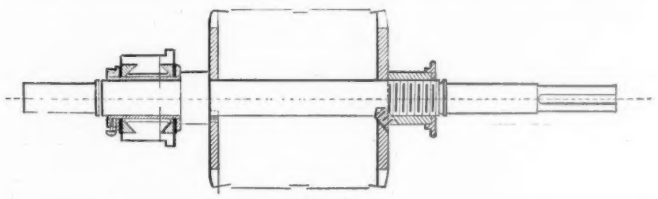


FIG. 4.

the current furnished by the machine, and, if not specially provided against, it may result in bringing the trailing pole corners to complete saturation and in completely reversing the field under the leading pole corners. While this distortion is no great evil in itself, the resultant effects may be, and usually are, very serious evils. All distortion of the natural field of a dynamo is sure to be attended by a diminution of the field strength resulting in a falling off of the electromotive force produced by the dynamo, and, if the distortion be very great, no amount of compounding will cause such a dynamo to give constant potential. The most serious evil, however, arises from the fact that the weakening of the field at the leading pole corners results in a shifting forward of the neutral point or diameter of commutation of the dynamo. The amount of such shifting depends on the amount of distortion, and this, in turn, varies with the load on the machine. Consequently, if the brushes are set on the normal neutral point when running light, the machine will spark badly under load and it becomes necessary to keep shifting the position of the brushes to meet every variation in load. More than this, unless the pole tips or armature lugs are saturated, a point of loading is soon reached, beyond which one finds no diameter of sparkless commutation, and the output of the machine has reached a maximum at this point, notwithstanding the fact that the load may be below that allowed by a safe heating limit. These facts, as before stated, are well understood by the more competent dynamo designers and receive the most careful consideration in the preparation of new designs. It must be confessed, however, that the principal part of the knowledge on this subject is the result of dearly bought experience and costly experiments, rather than of scientific study of the principles involved. Designers of dynamo machinery, with few exceptions, instead of aiming to prevent armature reaction, have endeavored to avoid its bad effects in various ways, and in some cases with fairly good results. The distorting effects of armature reaction become less in proportion as the reluctance of the air gap and armature core teeth are increased, and the wiser designers of the present day, taking advantage of these facts, are producing some very creditable machines. Probably some of them still believe, as some of the very best authorities on the subject of dynamo machinery have confessed to believing until quite recently, that armature reaction is a necessary evil, and if it were possible to prevent it entirely, the whole utility of the machine would disappear at the same time.

While making a thorough consideration of the subject of armature reaction some time since, one of the authors of this paper devised a means of entirely preventing armature reaction and resulting field distortion. On looking up the literature of the subject we found, mainly through the Patent Office records, that there were several workers in the field at a comparatively early date; viz., Prof. Elihu Thomson, Messrs. Andrews and Spencer, Mather, Forbes and possibly one or two others. The specifications given by Andrews and Spencer indicate clearly the technical side of this method for preventing armature reactions, while our part appears in the development of a plan for the practical application of the scheme technically outlined by them in 1886. This method consists in general in surrounding the armature with a stationary winding exactly similar in its magnetic effects to the armature winding, but directly opposed to it, and thus completely balancing all armature reaction. Fig. 1 is a diagram that shows the manner in which the coils are applied. Holes are provided immediately back of the pole surfaces, and through these holes are wound conductors which are placed in series with the armature. The number of ampere turns of the balancing coils crossing each pole face is equal to, and opposite in direction to the number of ampere turns on the corresponding part of the armature.

A small bipolar machine of about two and one-half kilowatts capacity was designed, constructed and tested during the Spring and Summer of 1891, and the results obtained were very encouraging, demonstrating beyond doubt the correctness of one's understanding of the principles involved. Since that time some half dozen or more multipolar machines of various sizes have been designed and constructed. All employ these balancing coils with various modifications of design and gave the following results.

Brief mention of these results have been made heretofore in the literature, while a complete report of the same is now made for the first time.* Figs. 2 and 3 are side and vertical views of the first machine; Fig. 4 is a side view of the toothed armature, and the following are the essential data of construction:

Field of cast-iron, two poles	
Diameter of the armature core over all	6 in.
Length of armature core	6 in.
Number of teeth	64
Number of commutator bars	64
Armature turns per bar	3
Size of armature conductor, B. & S. G.	12
Resistance of armature, ohms	.34
Speed, R. P. M.	1800
Output, amperes	25
Output, volts	100
Turns on field, 250 of No. 7, B & S. G.	
Balancing turns, wound in six grooves per pole face, 16 turns per groove, or a total of 96 turns of No. 6, B. & S. G.	
Resistance of balancing coils, ohms	.24

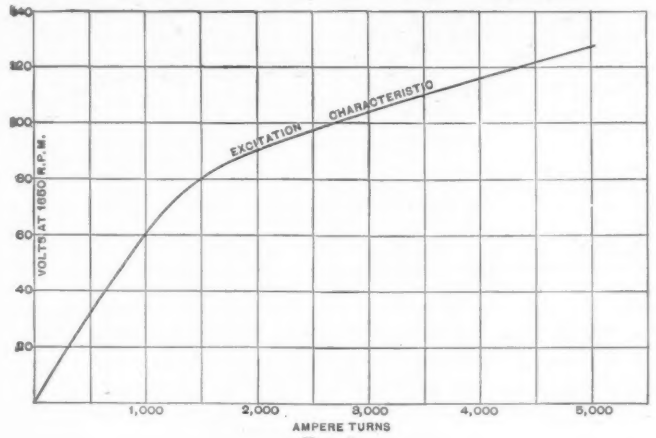


FIG. 5.

For dimensions of slots to accommodate balancing winding see Fig. 2.

The diagram of Fig. 5 gives the excitation characteristic at no load and a speed of 1,660 revolutions per minute. Fig. 5*a* is a diagram of results obtained by actual observation made on this machine when overloaded at normal excitation and speed, with and without the balancing coils. The pressure readings were taken at the brushes, and do not include the drop through the balancing coils when they were used. Characteristic 1 was obtained without the use of the balancing coils; characteristic 2 with the balancing coils, and characteristic 3 is the same as 2 with the balancing coils, when corrected for drop in pressure due to armature resistance. The same field excitation of 2,600 ampere turns was maintained at all times. It should be noted that without the balancing coils the pressure falls off uniformly and rapidly, from 109 volts at no load, to 41 volts at a load of 50 amperes, with violent sparking at all ranges of the overload. The potential differences due to the resistances of the carbon brushes were not nearly enough to reverse the currents in the coils while under the brushes, against the opposing electro-motive forces produced by the reversed fields established by the powerful armature reactions. The electro-motive force at the brushes falls off with a rapidity that is greater than that which would be due alone to the resistance of the

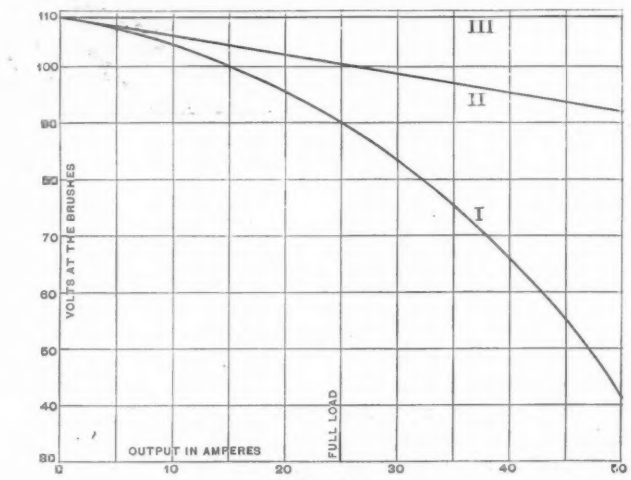


FIG. 5*a*.

* "On a Method for Balancing Armature Reaction," *Sibley's Journal of Engineering*, October, 1892, Vol. VII, page 17. "Electro-magnetism and the Construction of Dynamos," by Dugald C. Jackson, p. 172.

armature, because of the throttling action of those parts of the magnetic circuit that become saturated by the concentration of the induction by the route of the trailing pole corners. In marked contrast was the corresponding behavior of the machine with the balancing coils in circuit, as illustrated by curve II. There was no sparking at any point of the overloading; the brushes were fixed on the no load point, *i. e.*, at the zero of field induction, and at all loads the currents in the sections were easily reversed without spark, by the potential differences that were caused by the resistance of the carbon. There was no observable falling off of the induction through the armature under load when the balancing coils were used; and this is clearly indicated by curve 3, which, as stated before, is curve 2 corrected for the fall of pressure due to the resistance of the armature.

The diagrams with their respective legends that are given in Figs. 6 to 14, inclusive, are self-explanatory. Separate excitation was used on all the experiments on this machine. The pilot or third brush method was used for making the field explorations. In each instance the "exploration curve" is a record of the pilot brush readings, while the ordinates of the "magnetization" curve are proportional to the actual induction densities as deducted from the exploration curve. Fig. 6 shows that the induction is uniform over the entire pole face at no load, normal excitation and speed, as it should be without the coils. The motion of the armature conductors is from right to left. Fig. 7 shows the production of a reversed field in the presence of the brushes at a full load current, and normal field excitation without the balancing coil. Fig. 8 gives the result obtained for the same conditions, except that the balancing coil was used. The magnetization curve shows that the balancing coil slightly over-compensated the magnetic action of the armature, since the induction of the trailing pole tip is weakened, and that of the advanced tip strengthened, a phenomenon just the reverse of what commonly occurs. The diagrams of Figs. 9 and 10 are for substantially the same conditions as those of 7 and 8, except that the machine was operated as a motor. The results are precisely those one would expect—the same as those obtained for the dynamo, except that the sides on which the higher inductions occur are reversed in position.

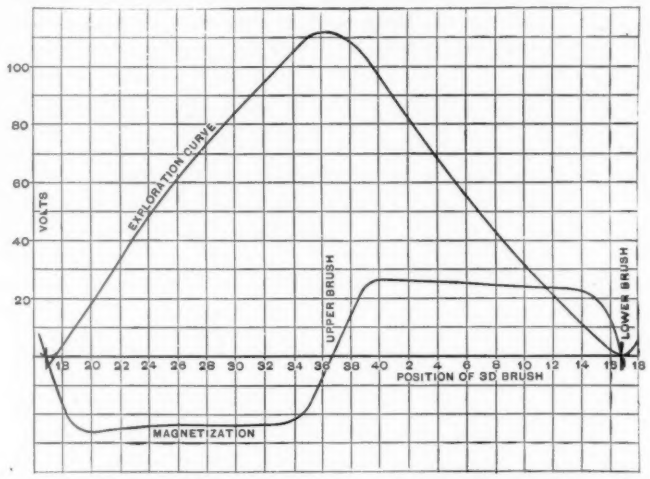


FIG. 6.—EXPLORATION CURVE AT NO LOAD. ELECTRO-MOTIVE FORCE, 105 V. EXCITING CURRENT, 10.4 C. SPEED, 1,800 REVOLUTIONS PER MINUTE. OPERATED AS A MOTOR WITHOUT BALANCING COIL.

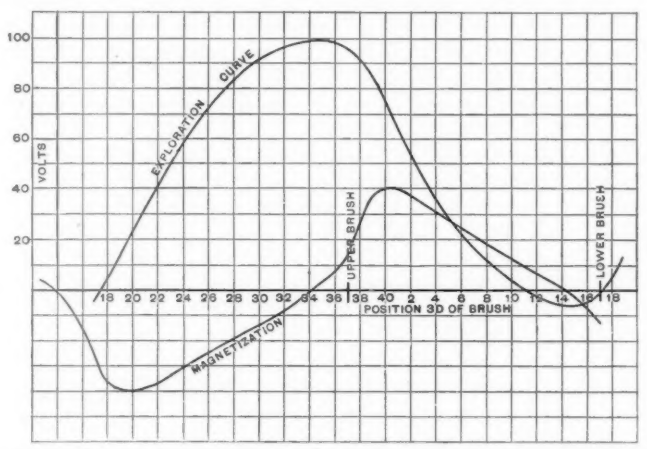


FIG. 7.—EXPLORATION CURVE, FULL LOAD. V = 97. C = 24. EXCITING CURRENT, 10.4 A. SPEED, 1,800 REVOLUTIONS PER MINUTE. OPERATED AS A DYNAMO WITHOUT BALANCING COIL.

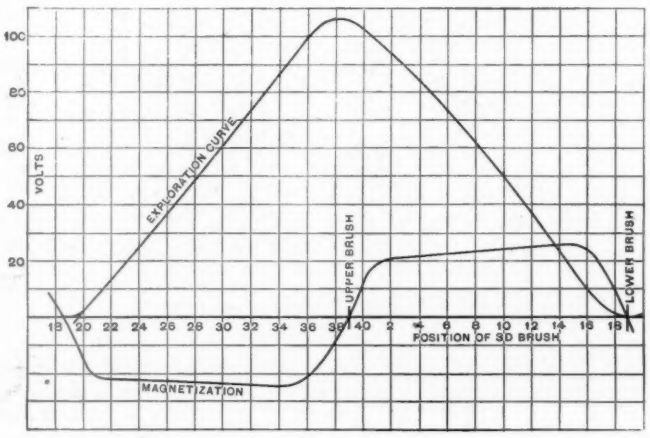


FIG. 8.—EXPLORATION CURVE, FULL LOAD. V = 105. C = 24.5 SPEED, 1,800 REVOLUTIONS PER MINUTE. EXCITING CURRENT, 10.4. OPERATED AS A DYNAMO WITH BALANCING COIL.

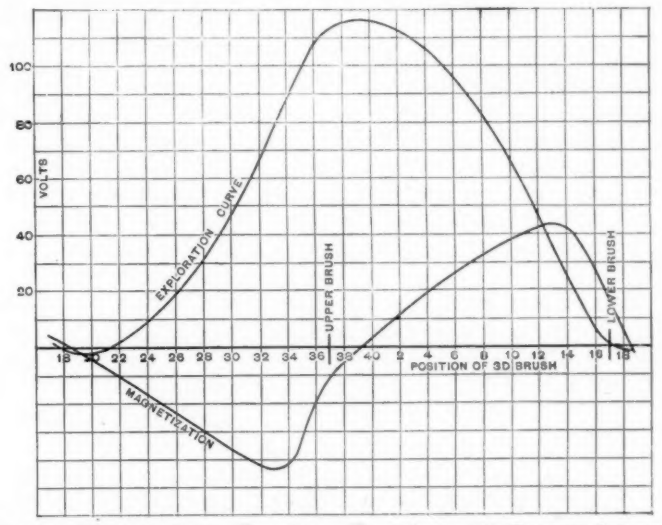


FIG. 9.—EXPLORATION CURVE, FULL LOAD. V = 114. C = 26. EXCITING CURRENT, 10.4 A. SPEED, 1,920 REVOLUTIONS PER MINUTE. OPERATED AS A MOTOR WITHOUT BALANCING COIL.

(*To be continued.*)

Mr. Lloyd Corrects Mr. Perry's Correction.

TO THE EDITOR OF ELECTRICAL REVIEW:

I notice in the last issue of your journal a letter from Mr. Nelson W. Perry making some corrections in his paper read in Cleveland.

I am amazed at his effrontery in leaving uncorrected in this letter his figures on the results of electric storage, when it was clearly shown at the convention that his figures were not only ridiculous, but false.

For instance, Mr. Edgar, of the Boston Edison Company, owners of the largest electric storage battery plant in the world, was kind enough to publish the exact cost of this battery, and Mr. Perry's figures are 50 per cent higher than the price Mr. Edgar's company actually paid.

If Mr. Perry had been possessed of ordinary intelligence he would have understood Mr. Edgar's figures, but that not being the case he could not distinguish between a horse-power and a horse-power hour. Figuring batteries at a 12-hour rate of discharge, the cost per horse-power hour is, of course, much lower than when worked at an hour and a half rate; and even when worked at an hour and a half rate, Mr. Edgar's figures were $33.33 per horse-power hour, which would amount to about $24 per horse-power when worked at a 12-hour rate.

It is a fact which cannot be disputed that batteries can be installed to-day, of central station type, for this latter figure, and why Mr. Perry should insist upon stating and re-stating figures of which he has absolutely no knowledge, I am at a loss to understand. By substituting correct figures as to first cost of storage batteries, and the cost of maintaining the same, the results obtained are as follows:

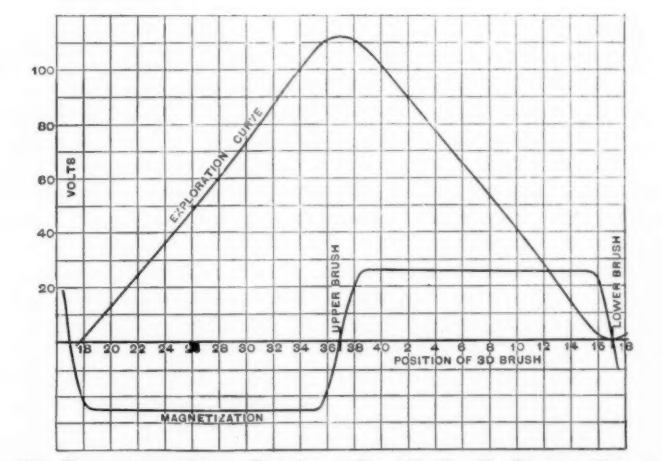


FIG. 10.—EXPLORATION CURVE, FULL LOAD. V = 112. C = 25. EXCITING CURRENT, 10.4 A. SPEED, 1,920 REVOLUTIONS PER MINUTE. OPERATED AS A MOTOR WITH BALANCING COIL.

RECAPITULATION.

	Coal. $1.75	Coal. $3.50	Saving Affected. Coal. $1.75	Coal. $3.50
Present method, steady load.....	48.68	65.02	....	....
Present gas engine	88.28	103.61	29.50	44.79
Combined feed and steam storage...	94.42	111.35	23.36	37.05
Feed storage.....	97.58	117.58	20.20	30.82
Without storage; load factor 25%..	117.78	148.40	....	....
Steam storage....	97.94	114.27	20.54	34.13
Complete battery storage.....	88.19	100.12	34.59	48.29

HERBERT LLOYD.

Philadelphia, March 22.

THE LOMBARD WATER-WHEEL GOVERNOR.

AN INVENTION OF GREAT VALUE IN THE LINE OF ELECTRICAL DEVELOPMENT—ITS SALIENT FEATURES AND THE WORK IT HAS ALREADY ACCOMPLISHED.

Since the development of the long-distance transmission of power and the application of man's ingenuity to the forces of nature in utilizing them to this end, the main difficulty experienced has been in properly controlling the vast power of water and governing its force in accordance with the work required of it and under the various conditions which may arise.

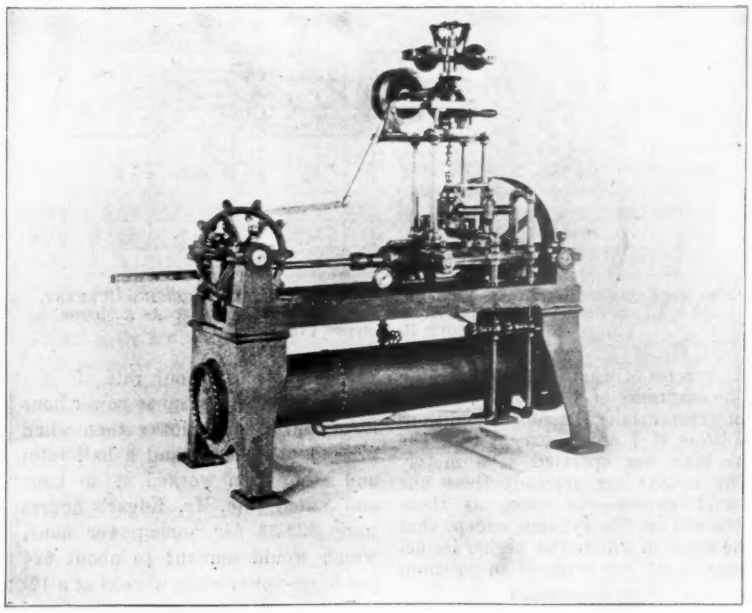


FIG. 1.—LOMBARD WATER-WHEEL GOVERNOR, TYPE A.

Up to the present time this has never been done in an altogether satisfactory manner, and though a number of devices have been tried with more or less success, and some little advance made in this direction, the best of them have been but crude attempts and entirely inadequate to the demands of an extensive plant, especially where there was a heavy and sudden variation of load.

The vast and growing importance of the interests involved have led to many efforts toward a solution of the problem of turbine governing, and in the apparatus now being put on the market by the Lombard Water-Wheel Governor Company, of Boston, Mass., they believe perfection has about been reached. Several installations have been made, and in every instance the new governor, though working under the severest possible conditions, has more than fulfilled every requirement.

As it is something entirely new and of a nature to make its performance of interest to every power user, we present herewith a brief but comprehensive description of the machine itself, together with illustrations of the various types and a few words in regard to the results obtained in practical operation.

By referring to Figs. 1, 2 and 3, it may be seen that the Lombard water-wheel governor consists essentially of an hydraulic piston, which applies its thrust in either direction to the rack, pinion and gears at the left side of the machine. There gears transmit the motion of the piston to the gate mechanism of the turbine.

The actuating force which operates the hydraulic piston is air compressed under about 15 atmospheres (210 pounds gauge pressure). This air is contained in the cylindrical tank under the bed plate of the governor, and the pressure is maintained by a pump operated by the band wheel shown on the back side of the machine in Fig. 1, and on the front side of the machine in Figs. 2 and 3.

The pressure tank is about one-third full of a thin, non-viscous oil and the piping is such that oil, and never air, enters the hydraulic cylinder. It will be noticed that about one-third of the distance from the left-hand end of the pressure tank there is a row of rivet heads. At this point there is a tight partition across the tank and there is no connection between the right and the left-hand end of the tanks except by way of the piping and through the hydraulic cylinder. In the right-hand end of tank are oil and air under high pressure, and in the left-hand end of the tank is a vacuum. The piping is such that the oil is discharged from the hydraulic cylinder into the vacuum tank and is immediately returned by the pump to the pressure tank. In this way a constant pressure and a constant vacuum are maintained. In other words, the oil circulates under pressure in a closed system without any access to atmospheric pressure.

The circulating system is provided with a lever throttle valve and globe valves at various appropriate points; also pressure and vacuum gauges.

The centrifugal governor balls actuate a perfectly balanced piston valve which stands in the circulating system. This valve has a lap of one-sixty-fourth of an inch, and a motion of that amount one way or the other, as the speed varies, causing the hydraulic piston and train of gears to open or close the gates of the turbine.

The mechanism of the valve motion is such that the full amount of motion due to the position of the balls is not used; in other words, the governor does not continue opening or closing the gates of the turbine until the centrifugal balls have resumed their normal position, but stops at such a position that when the various inertia forces have been absorbed the turbine gates will be in the proper position for the new load.

This peculiar motion of the valve is positive, automatic and adjustable, and gives perfect control of the turbine, no matter how great the variation of the load. By this it is not meant that this governor will hold a wheel to an absolutely constant speed, but it gives a speed regulation that compares favorably with the best steam engine practice, and marks the beginning of a new era in the art of generating power by turbines.

The mechanism and operation of the governor being now thoroughly understood, the next thing is to demonstrate what it is capable of in practice, and in this connection the accompanying diagram, Fig. 4, will be of interest. The readings shown were taken in the wheel house of the Baltic Power Company, of Baltic, Conn., between 6.20 and 6.50 P. M. on March 6, and show the variations of load and speed at half-minute intervals.

The figures at the bottom of the diagram represent minutes. The figures at each end of the diagram represent load in horse-power; and the curve shows the variation of load each half minute. For convenience the load in horse-power is indicated by figures where the load crosses the vertical lines, that is at half-minute intervals. The figures parallel with the load line show the variation in load each half minute. Example: At 6.27 P. M. (see Fig. 4) the load was 57 horse-power. One half minute later it was 273 horse-power, showing an increase of load of 216 horse-power in half a minute; at 6.28 P. M. the load was 446 horse-power, showing an increase of 173 horse-power in half a minute, or a variation in load in one minute of 216+173=389 horse-power.

Now by following the vertical lines to the top of the diagram the variations in speed may be seen. The dotted line shows the speed at which the wheels should have run and the full line shows the speed at which they did run. The figures above the speed line show the revolutions per minute of the tachometer shaft; and the figures below the speed line show the per cent variation from normal speed. In this connection it must be noted that the figures referring to per cent variations of speed are decimal fractions of one per cent—not whole per cents. Example: At 6.27 P. M. the speed was one per cent higher than it should have been. One half minute later, the load having increased 216 horse-power, the wheel speed was just right; one half minute later (6.27½) the load now being 389 horse-power greater than one minute previous, the speed is one per cent below what it should have been.

The greatest variation may be seen at 6.31½ P. M., when the speed was two and one-tenth per cent higher than it should have been.

An interesting example, showing how this governor will bring a wheel to normal speed under a wide but continuous variation of load, may be seen at 6.32½ P. M. Here the speed was two-tenths of one per cent over normal. A heavy load begins to come on rapidly; the speed first falls five-tenths of one per cent under speed, and then rapidly comes back to where it should be, so that at 6.34 P. M. the speed is just right, though the load has increased 397 horse-power.

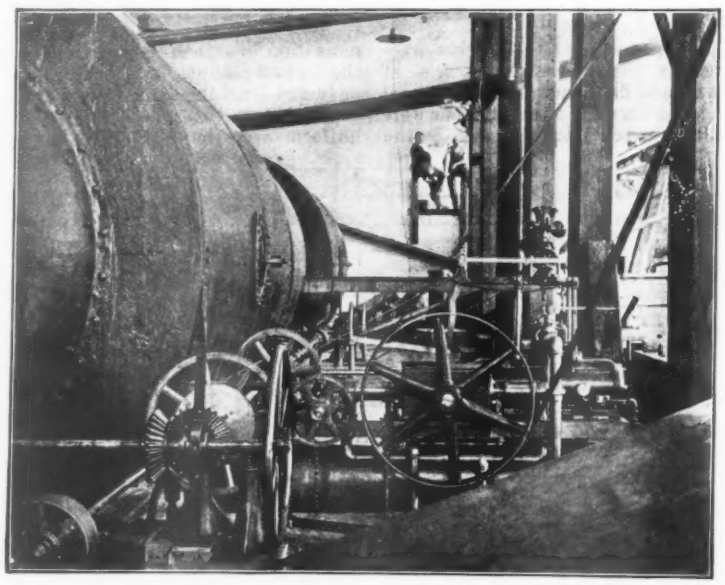


FIG. 2.—LOMBARD WATER-WHEEL GOVERNOR IN WHEEL HOUSE OF BALTIC POWER COMPANY, BALTIC, CONN.

This plant consists of three pairs of Holmes horizontal wheels, working under 35 feet head. These wheels drive two General Electric three-phase generators. At Taftville, five and one-half miles away, two General Electric three-phase motors furnish about 400 horse-power used for driving cotton spinning and weaving

machinery; they also drive the General Electric railway generators, which furnish power for the Norwich Electric Railway (12 miles); likewise they operate a 250 horse-power electric locomotive used to handle freight cars between Tafts, on the New York and New England road, and the Taftville Mills.

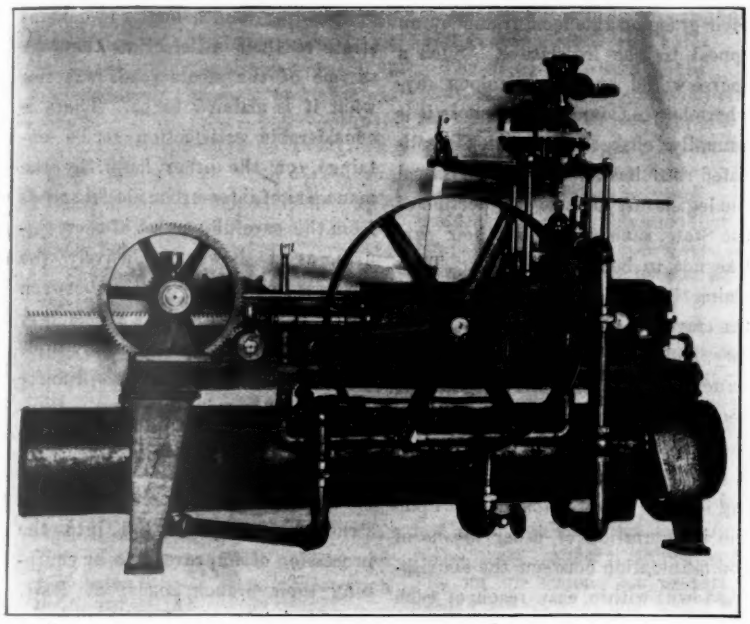


FIG. 3.—LOMBARD WATER-WHEEL GOVERNOR, TYPE C.

The diagram shown herewith was purposely taken between 6.20 and 6.50 P. M., when the mills at Taftville were shut down and the load consisted solely of the Norwich Electric Railway and the electric locomotive, the railway load alone being much more difficult to govern than the railroad and the mill combined.

It should be added that one small incandescent machine is also driven from the jack shaft at Baltic, and no appreciable variation in the lights is noticed.

At the time this diagram was taken the plant was being driven by one pair of 33-inch horizontal turbines, controlled by a "Type C" Lombard water-wheel governor.

Another instance of where the Lombard governor has proved its good qualities is in the power house of the Public Works Company, of Bangor. The power house is located at Vesey, about four miles from Bangor, to which place the power is transmitted, and the outfit consists of five vertical 48-inch Holmes turbines, driving four General Electric railway generators. The conditions under which the plant is operated are exceptionally severe, owing to the great and sudden variations in load, and before the advent of the Lombard governor it was found impossible to control the power except by hand regulation, and then only imperfectly and with the greatest difficulty. A Lombard governor was installed about four months ago, and since that time there has never been a shut down nor an accident of any kind.

The plant of the Hollingsworth & Whitney Paper Company, at Waterville, Me., is another instance in which the work is carried on under severe conditions, and here a "Type A" governor is regulating a wheel plant driving a lot of pulp grinding machinery.

Briefly summed up, it may be said of the Lombard water-wheel governor that it governs; it is of a high order of mechanical design and is thoroughly built, with interchangeable parts, of the best materials by skilled mechanics; the whole mechanism is simple of operation and may be readily handled by any one competent to have charge of water-wheels; if the governor belt breaks the governor shuts the plant down quietly; it is sold with a positive guarantee, by which is meant that the purchaser is put to no expense whatever until the governor controls the plant within the limits agreed upon in the contract.

The installation of a water-wheel governor and the work it is called upon to perform is a very different matter from that required of a steam plant, and in this connection there are many factors to be considered which vary largely in accordance with the nature of the work to be performed, and with a full appreciation of these facts, the Lombard company build their governor to meet the peculiar requirements of each case, whatever they may be.

Turbines vary greatly in the amount of power necessary to move their gates, and it is not often that the amount of power required to govern a turbine is proportional to its horse-power output. It is often the case that a wheel giving a large amount of power is constructed with gates so nicely adjusted and balanced that but little power is required to govern it, and again we often find wheels that give but little power with gates so constructed that they move very hard.

It is to the intelligent comprehension of these requirements and their ability to meet them that the success of the company is due, and in Mr. Allan V. Garratt, chief engineer, they have the right man in the right place. Mr. Garratt is a thorough mechanic, a capital draughtsman, and has the happy faculty of grasping the needs of a situation quickly and meeting them with equal promptness.

Mr. Nathaniel Lombard is the inventor of the governor, superintendent of the works and a very able man.

Mr. Henry A. Clark, so well known in electrical circles throughout the country, is the treasurer and general manager of the company.

A new three-story brick factory has recently been built at 61 Hampshire street, Boston, and is fitted with every facility for manufacturing. The advent of this company into the field of electrical development should be welcomed by all who are interested in this leading industry of the nineteenth century.

ELECTRIC LIGHT FLASHES.

The Versailles, Ky., City Council has decided to build and operate its own electric light plant.

Petitions are being circulated to allow Medford, Wis., to issue $5,000 of bonds for an electric light plant.

The taxpayers of Green Island, N. Y., have voted to bond the village for $20,000 for a new electric light plant.

Muskegon, Mich., is pushing a scheme to erect a large building, with sections furnished with light and motive power, to be rented to small manufacturing concerns looking for a location.

Electric street lighting is being generally adopted by the villages of the Mohawk valley, Canajoharie, N. Y., having just contracted for 30 arc lights of 2,000 candle-power, costing $2,000 per annum, the lights to burn until 2 A. M.

The City Council of Lake City, Minn., has resolved that the question of putting in electric lights shall be submitted to the voters at the charter election this Spring to decide whether the city shall be bonded for the necessary sum to pay for the plant.

The Cheltenham Electric Light, Heat and Power Company, Oak Lane, Philadelphia, Pa., are negotiating for an increase in station capacity. They will install a 1,000-volt 150-kilowatt generator, a 200 horse-power high-speed compound engine and a condenser to suit.

The new Freeport, Ill., Light and Fuel Company, which was recently incorporated with a capital stock of $100,000, has elected these officers: President, Charles D. Knowlton; vice-president, Jacob Krohn; treasurer, William O. Wright; secretary and manager, Z. T. F. Runner.

The International Trust Company has sold the property of the Leicester, Mass., Electric Company because of the default on the interest to the bondholders. It was bid in by the bondholders, represented by Edwin L. Waters, for the nominal price of $16,000; first mortgage on the property being $20,000, with interest of $2,000 added.

Pawnee City, Neb., will own her own electric light plant. This subject has been one of controversy for some time, but the city council and those representing the electric light company have come to an understanding, whereby the city purchases the plant and assumes control in a few days. It will then be operated in connection with the waterworks system, now owned by the city.

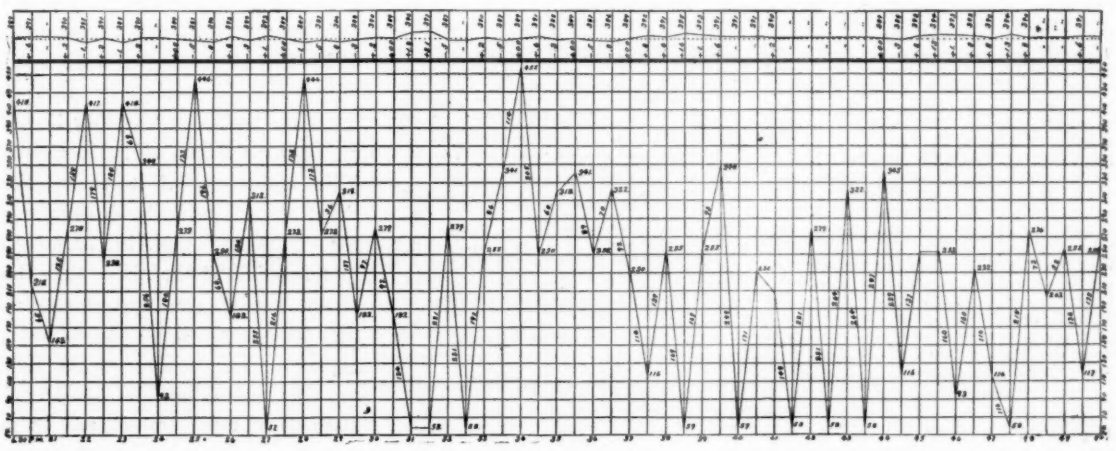


FIG. 4.—LOAD AND SPEED DIAGRAM TAKEN AT PLANT OF BALTIC POWER COMPANY, BALTIC, CONN., MARCH 6, 1895.

The plant of the Bloomington, Ill., Electric Light and Power Company was totally destroyed by fire on March 18. Loss, $75,000; insurance, $40,000.

The syndicate which recently bought the water-power near Hoosac Tunnel, Massachusetts, is rapidly pushing plans for the installation of a gigantic electric power station.

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It don't pay to advertise unless you want to do business.

Where is the genius that should be making electrical brakes for our trolley cars? Is he slumbering, or has he not awakened to the necessity for such an appliance?—*Brooklyn, N. Y., Eagle.*

Mr. Elmer A. Sperry, of Cleveland, Ohio, should let the public know, through the electrical press, whether or not he has a practical electric brake.

TROLLEY VERSUS STEAM ROADS.

We made mention some time ago of the fact that the steam roads in Connecticut were waking up to the extent of the travel they are losing through the extensions of the electric roads, and were endeavoring to retain their grasp on this local traffic by an appeal to the legislature. Such a course would appear ridiculous anywhere but in Connecticut, but as it is annually charged that the Consolidated road has for many years owned the legislature and the best portion of the State, such action on their part was not to be wondered at. They claim they are giving the public all the traveling facilities that are necessary, and on the ground of prior construction should be allowed all the benefits accruing therefrom. Their claim that their service is satisfactory is most thoroughly refuted in the falling off of travel immediately upon the inauguration of other means of communication between the flourishing towns within easy reach of each other, and the magnitude of this change of patronage may be gathered from the following figures, which are taken from the report of President J. M. Hall, of the Consolidated, at a recent hearing before the Railroad Committee of the legislature. Mr. Hall reports the falling off of 50 per cent of the regular traffic between Norwalk and Rowayton, a loss of 80 per cent between Bridgeport and Southport, 50 per cent between New Haven and Woodmont, and between New Haven and West Haven a loss of 70 per cent; between Wallingford and Meriden there is a difference of 30 per cent; New Haven and Yalesville comes next with a loss of 45 per cent; between Meriden and Yalesville there is a falling of 90 per cent; between Waterbury and Naugatuck 95 per cent, and between Southington and Plantsville the electric roads have gathered in all the traffic, as the New Haven road reports a loss of 100 per cent. This statement, if it shows the situation as it really is, should prove the strongest possible argument in refutation of the claim that the steam roads are furnishing, as they say they are, all the facilities required. The public are not slow to take advantage of improved methods of rapid transit, and these figures prove conclusively that the electric roads are an improvement. While the action of the railroad officials may be perfectly understood in the light of these developments, and while they are undoubtedly justified in doing all they can to retrieve such losses as are here indicated, it would seem that not even the Connecticut Legislature would voluntarily be guilty of throwing obstructions in the way of rapid transit facilities which are so evidently appreciated by the traveling public. The fact that between the towns of Naugatuck and Waterbury the sale of tickets has fallen off at the rate of 7,000 per month ought to demonstrate to their satisfaction that the service of the steam roads was not what it is claimed to be. There is considerable satisfaction to be obtained, on the other hand, by the managers of inter-urban electric roads from the careful perusal of these figures, as it shows conclusively the business that can be built up between New England towns by a satisfactory electric service. It is naturally to be expected that the railroads will make a fight for their fast receding patronage, but if they would read the handwriting on the wall aright, they would cease fruitless efforts to obstruct progress, and fall into the procession of improvement by equipping their branch roads, at least, with electricity, and furnish a service which will secure their fair share of travel in the competition which they are unable to avoid.

NEW YORK'S ELEVATED RAILWAY SERVICE.

It is a trite saying that New Yorkers will put up with more inconveniences and impositions than any other class of citizens in the world. This is well shown in the equanimity with which we accept the miserable service offered by the elevated railroads of this city. The trains run on a schedule beautifully inconsistent with the demands of the traffic, the majority of the cars are dirty, old and foul-smelling, the oil lamps give off little light and large odors, and the means of ventilating the cars are practically useless. The service of the Sixth avenue road during busy hours was exemplified one day last week when passengers were obliged to wait eight minutes at Twenty-eighth street for a down town train at eight o'clock in the morning. Again, on the same day, at 6.15 o'clock in the evening, the trip from Park place to One Hundred and Twenty-fifth street occupied just an hour. The schedule time, as posted at several stations for the convenience of ticket choppers, for the run from the Battery to One Hundred and Fifty-fifth street is but 55 minutes. Nothing can be done to ameliorate this unsatisfactory state of affairs as long as New Yorkers will complaisantly tolerate such service. One day, when we are old and feeble and won't care to travel much, there will be a genuine rapid transit road in New York. We probably shall not live to enjoy the new road, but it will be a blessing for our grandchildren.

Wall Street and the Electrical Stock Market.

The stock and bond market was strong and active all the week under an excellent demand. Events have demonstrated that the bond syndicate has taken matters firmly in hand and proposes to turn the tide of exchange by rendering American securities more attractive. There was only one sentiment in Wall street during the week, and that was bullish. This, however, is not particularly surprising to those who know the ways of Wall street and realize that a movement in the opposite direction would make just as many bears.

The event of all controlling interest in the financial world was the intelligence that Westinghouse and General Electric had agreed to pool their patents, with the idea of obviating litigation and competition of the cut-throat sort. This is an outgrowth of the Bate refrigerator decision, which placed the two companies, in as far as their patents are concerned, more nearly on a parity. They had a great deal to lose and very little to gain by a continuation of the litigation.

It is understood that Westinghouse is to use the General Electric patents without fear of litigation, and General Electric will have the same privilege with Westinghouse patents. It was rumored, also, that the Siemens & Halske in America had sold out to General Electric.

This then is the explanation of the "wild and woolly" consolidation stories sent out by the lay and technical press. That it is regarded as a good thing for the stock is evidenced by the sharp advance of General Electric during the week. The range was from 29¼ to 36; the last figures were the highest. The preferred stock gained a point, selling at 65. The debenture bonds sold at 89 to 89½. Pronounced activity occurred in the stock, transactions involving over 115,000 shares. The market excitement reached its height on Saturday.

A thorough investigation of the affairs of the North American Company is on the carpet. We understand that steps have been taken to ascertain how the assets have dwindled year by year, and to recover where possible. About the only assets of any importance are the Milwaukee street railway and lighting plants and the Cincinnati lighting plants. Talk of an investigation was sufficient to send the stock up a point or more during the week.

Of the other electrical stocks there was some inquiry: Edison Illuminating of New York advanced 3 points to 97. The bonds sold from 106 to 106⅝. American Telegraph and Cable fluctuated between 90 and 91.

Consolidated Electric Storage has declared a dividend of 1 per cent, payable April 10. Books close March 31 and open April 10.

On other exchanges, New England Telephone gained 2, touching 70. Erie Telephone was strong at 50½. Electric Storage Battery lost a point during the week, closing at 30. Westinghouse securities were very strong, because of the pooling arrangement. The common was bid 35 and held at 35¼. The preferred sold ex-dividend at 51 to 51½. This is higher than the price recorded before the dividend was declared. BAIN.

New York, March 23, 1895.

OUR BOSTON LETTER.

The Electric Heat Alarm Company, of Boston, have just issued an exceedingly neat thing in the way of a desk calendar, in which is included also their descriptive catalogue No. 4. This is handsomely illustrated and very complete, and the combination is something which is valuable as well as ornamental.

The Globe Electric Light Company, of this city, have recently closed negotiations for the purchase of a fine manufacturing property in Roxbury, and are now getting machinery into place as rapidly as possible. The building is admirably adapted for lamp manufacture, and when completely equipped will be one of the finest properties in this section. The building is of brick, four stories in height and rests upon a granite foundation, and its stability is further increased by 40 buttress walls of brick, extending from the granite foundation three feet from the base of the structure and apexing at the roof. The dimensions are 150 by 65 feet, and the building is equipped with every modern improvement. The lot on which the property is located contains 51,000 square feet, and the property has an assessed valuation of $35,000. The Globe company are pushing matters to the utmost, getting machinery into place and expect to be able to turn out lamps within a very few weeks.

C. H. Morse, electrician for the city of Cambridge, Mass., after a series of experiments, has demonstrated, to his entire satisfaction, that telephones can be introduced into police signal boxes and the signal wires used for telephonic communication, thus doing away with the special wires heretofore considered necessary. Mr. Morse has worked this matter out very carefully, and has already installed a system which may be considered the modern system of the day, as it is superior, both as regards efficiency and economy, to anything heretofore in use. In this case, as in others, the National Telephone Company, of this city, have filled an important part in the success which has been achieved, and their instruments have been adopted as best meeting the requirements. The National Telephone Company have just received a large order for specially wound compound receivers and granular carbon transmitters, as well as special switches, which are adaptable to any signaling system now in use. By the new device an officer can signal the station and carry on conversation therewith without in any way interfering with other signal calls on the same circuit. It is claimed that by the adoption of this system cities and towns, contemplating the installation of police and fire alarm signals, can put them in at about one-half the cost of the present system now in vogue, and at the same time purchase their telephones outright. The National Telephone Company are prepared to furnish a specially wound receiver, of, say, 25 ohms, for this service at $1.25 each and granular carbon transmitters in walnut boxes guaranteed to talk through induction from powerful wires at $3 each. Both Mr. C. H. Morse and Mr. J. D. Leatherbee, of the National Telephone Company, will be pleased to give full details of the new system to all interested officials and correspondence is invited.

H. G. T.

Boston, March 23, 1895.

Attacking the Bell Telephone in Chicago.

Ex-Solicitor General Aldrich, attorney for Milo G. Kellogg, who is interested in the Central Union Telephone Company, is said to be preparing a fresh onslaught against the Bell Telephone Company through the Chicago courts. General Aldrich is preparing a bill to limit the power of the Bell company in making contracts with its licensed companies and demanding and collecting rentals on the telephone receiver, which is not now covered by a patent and which can be bought in the open market for about $1.

Mr. Kellogg, at a recent meeting of the directors of the Central Union Telephone Company, is said to have alleged that that company was paying the parent Bell company $2.50 rental per annum for this receiver, which could be bought for $1, and that the Central Union was using about 25,000 of them. The directors, it is said, stated in reply that the Bell company had many patents indispensable to the business and that they thought it was the part of wisdom to yield in the matter under discussion. Mr. Kellogg said he would hold them personally responsible for the continuance of the payment of these rentals.

In an interview, Mr. Aldrich says:

"The bill I am preparing denies the right of the Bell Telephone Company to make a contract with itself. It seeks to restrain the payment of excessive rentals which have been forced. It involves, in a word, the contract covering instruments used, which is made by the Bell with its constituents. We shall also ask that the court compel the Bell company to carry out its original contract with the Central Union as to territory, charging that a portion of the latter rightfully belonging to the Central Union has been given over to the Long Distance company to assist the development of the latter."

PERSONAL.

Henry Villard is expected to arrive in New York about the middle of April.

General Manager Charles R. Huntley, of the Buffalo General Electric Company, visited New York last week.

Mr. F. P. Fish has severed his official connection as counsel to the General Electric Company, and has resumed his private practice. His services, however, will still be utilized by the General Electric Company.

General Manager Henry Hine and Mr. William Stanley, Jr., of the Stanley Electric Manufacturing Company, Pittsfield, Mass., were guests of the Waldorf, in New York, last week. Mr. Hine reports that his company is doing a splendid business at good prices.

How Trolley Competition Cuts Into Steam Railway Receipts.

Representatives of the New York, New Haven & Hartford and New York & New England Railroad Companies appeared before the Railroad Committee of the Connecticut Legislature on March 19 to protest against the granting of charters to electric lines paralleling existing railroads. Ex-Judge John M. Hall, vice-president of the New York, New Haven & Hartford Railroad, presented the following statistics showing the depreciation in receipt of fares during the past three months, which are traced directly to the competition by electric railroads where they parallel the New Haven lines between stations:

Between Norwalk and Rowayton, a loss of 50 per cent of the entire business. Between Bridgeport and Southport, a loss of 80 per cent of all business. Between Bridgeport and Stratford, $35 per day. Between New Haven and Woodmont station, 50 per cent of all business. Between New Haven and West Haven, 70 per cent of all business. Between Wallingford and Meriden, 30 per cent of all business. Between New Haven and Lake Saltonstall, 45 per cent of all business. Between Meriden and Yalesville, about 90 per cent of all business. Between Southington and Plantville, practically all the business. Between Unionville and Hartford, 40 per cent of all business. Between Hartford and Glastonbury, 30 per cent of all business. Between Derby, Ansonia and Birmingham, 90 per cent of all business. Between Ansonia and Derby, $1,500 a year. Between Naugatuck and Waterbury, $300 a month. Between Union City and Waterbury, $170 per month. Between Waterbury and Naugatuck, 90 per cent of all business. Between Winnipank and South Norwalk, 50 per cent of all business. Between South Norwalk and Winnipank, 90 per cent of all business. Between Norwalk and Royalton, 50 per cent of all business. Between Danbury and Bethel, 75 per cent of all business.

Death of Wm. A. Hammett.

William A. Hammett, one of the best known engine salesmen in the country, was found dead in bed at the Crawford House, Boston, on March 21. For the last six years Mr. Hammett had been the New York manager for the Hooven, Owens & Rentschler Company, of Hamilton, Ohio. He had gone to Boston in relation to business pending between his company and the Lynn & Boston Railroad Company. On Wednesday evening about 11 o'clock Mr. Hammett retired to his room in the hotel and at nine o'clock on Thursday morning his death, which is reported to have been caused by heart disease, was discovered. Mr. Hammett was 47 years old. He lived at New Rochelle, N. Y., and leaves a widow but no children. The funeral services were held in Boston last Friday. President J. C. Hooven, of the Hooven, Owens & Rentschler Company, came to New York last week to take charge of Mr. Hammett's affairs pending the appointment of his successor.

TELEPHONE NEWS AND COMMENT.

Telephone wires at Reading, Pa., are to go under ground.

A new telephone company has been organized at Mobile, Ala.

The Harrison company is after a franchise at Saginaw, Mich.

A new telephone company has asked for street privileges at Zanesville, O.

Fostoria, Ohio, now has long-distance connection with New York and Chicago.

The Clay County, Ill., Telephone Company has obtained a county franchise.

Prof. Alexander Graham Bell and his wife are enjoying a pleasure trip in Mexico.

The Harrison company is to build a line from Fort Wayne to New Haven, Ind.

The Central District and Printing Telegraph Company has announced a cut in rates.

The Nebraska Telephone Company has cut rates about 50 per cent in South Omaha.

The new court house at Joplin, Mo., will have a complete interior telephone system.

The Western Telephone Construction Company will organize a new local company in Pittsburgh.

The Southern Bell Telephone and Telegraph Company will build a line between Jacksonville and Ocala, Fla.

The Citizens' Telephone Company, using the Harrison instruments, has been granted a franchise at Sharon, Pa.

New Hope, Pa., has sued telegraph and telephone companies for failure to pay taxes on poles and wires in the borough.

The Harrison Telephone Company, has been granted a franchise at Canton, Pa., and promises to cut rates one-half.

The East Tennessee Telephone Company will connect Knoxville and Chattanooga by a metallic circuit 112 miles long.

The American Bell Telephone Company has added Director Cochrane to the executive committee, making four members.

It is said that the Southern New England Telephone Company will begin soon to put in solid back wall instruments at an annual rental of $25.

A new telephone company, which is making contracts at half the rate charged by the old company, is being organized at New Castle, Pa.

The Alabama Telephone and Construction Company, of Selma, Ala., has been granted a franchise by the city council of Birmingham, Ala.

The Fort Wayne, Ind., Harrison Telephone Company, which is reported to have 700 subscribers, will begin at once to construct its exchange at Fort Wayne.

The Progress Telephone and Telegraph Company, of West Milton, Ohio, which was incorporated on March 18, intends constructing and operating a system of exchanges and toll lines.

The Alexandria Telephone Company, Limited, has made a contract with E. N. Maxwell to construct a telephone exchange at Alexandria, La., with 50 instruments, to be completed by April 15.

It is reported that a Grand Rapids syndicate has bought the right to use the Harrison telephone patents in Louisiana, Mississippi and Arkansas, and will proceed to establish local exchanges in that territory.

Wisconsin Telephone Company officials have been looking over the ground preparatory to building a metallic circuit line direct from Watertown, Wis., to Chicago by way of Elkhorn, Williams Bay, Lake Geneva and Genoa Junction.

A new telephone company is at work in Baltimore, Md., securing subscribers. It proposes to fight the Chesapeake & Potomac company by cutting down the rate over 60 per cent. Its name is the Home Telephone Company and it proposes to begin business December 1.

In some of the long-distance telephone offices it is now the practice to give a person a stop watch when he goes into the booth to talk. He starts it when he starts his conversation, and stops it when through, so that he keeps his own time and never has occasion for a controversy over the time occupied.

The Delaware & Atlantic Telephone Company has begun a reduction in rates for telephone rentals, and also for single messages or pay calls at some of its public stations. This is to be followed by a similar reduction in other sections. At Darby and Lansdowne, Pa., the telephone rentals have been reduced about 50 per cent.

Our inquiry for the address of the manufacturer of the Reynolds transmitter brought many replies, and our correspondent promptly received the information. The Mutual Telephone Company, of Fort Scott, Kansas, writes: "We are using the Reynolds transmitter in our exchange and invite any one who desires to come here and inspect them."

W. C. Page, of Palmyra, N. Y., who has been connected with the Empire State Telephone and Telegraph Company for the past 13 years as superintendent, has severed his connection with that company, to take effect April 1. Another company is said to be negotiating with Mr. Page to take the management of their business for Western New York.

Senator Crouse's telephone bill proposes to prevent any discrimination on the part of Pennsylvania telephone companies against individuals or firms, and limits the charge for one telephone to $7 per month, and where more than one telephone is used by the same party an additional charge of $1 per month for each additional mile distance from the telephone exchange. The collection of any excess of rate is punishable by a fine not exceeding $500 for each offense.

The local stockholders of the West Shore Telephone Company agree that a slight rental should be charged against the account of every person who owns or who operates a 'phone on their system. The line can never be sustained unless such a charge is made. The wires of the company will need repairing occasionally, and unless the directors ask the stockholders to pay, who will do the repairing?—*Kingston, N. Y., Freeman.*

The idea of charging anything—even a slight rental—and to *everybody*, too!

The Western Telephone Construction Company, of Chicago, is reported to have entered Pittsburgh's territory and interested a number of capitalists of that city. It is said that the franchises and plants in operation by this company include exchanges at Cambridge, Van Wert, Mansfield, Canton, Zanesville, Mt. Vernon, Newark, Bowling Green, Norwalk and other Northern Ohio towns. A trunk line is said to be in course of construction between Cleveland and Parkersburg, W. Va., and one is to be built between Pittsburgh and Washington City, D. C.

The new telephone building recently opened in Salt Lake City, Utah, by the Rocky Mountain Bell Telephone Company, is situated just north of the old Salt Lake Theater on State street, and is a three-story building with a deep basement and high attic, 30x93 feet. It is built of brick, with Kyune stone front tastefully carved. The walls are very heavy, and the construction is what is known as the "expanded metal fireproof construction." The entire building is used by the telephone company. The rear of the basement is used for a storeroom for the entire system. In the front is the main terminal room and the linemen's room and closets and lavatories for the use of the linemen. On the first floor the front room is well equipped with public telephone sound-proof booths, and in this room are situated the toll boards, where all toll business outside of Salt Lake City is conducted from 8 o'clock in the morning until 9 o'clock at night. There is an additional booth on this floor where an automatic telephone is placed, which can be used at all hours of the night. The second room is occupied by the general foreman, who has immediate charge of all linemen and construction in the city. The next room is given to the inspectors, and the large room at the rear is used as a workshop, and is equipped with electric lathes and all necessary appliances. The second floor of the building is devoted to the general offices of the company; the large front room on the east is President Geo. Y. Wallace's office, with a small private office adjacent. The second room is the treasurer's office; the third the general superintendent's office; and the fourth the secretary's office. The front of the third story is at present used by the superintendent as his living rooms, and the rear for the central office and general switchboard. Adjacent to the central office are large lavatories and a retiring room for the operators.

By the failure of Mayor Schieren, of Brooklyn, N. Y., to veto resolutions adopted by the board of aldermen, a committee has been appointed to investigate certain vague charges against the New York & New Jersey Telephone Company. No money has been appropriated, however, to carry on the investigation, but the powers of the committee are large. The New York & Eastern Telegraph and Telephone Company is credited with inspiring the resolutions which are regarded with suspicion, especially because of the indefinite phraseology employed. The general belief is that the sole object of the scheme is to force the New York & New Jersey Company to some sort of terms with the New York & Eastern Company. When questioned by a reporter, Mr. W. D. Sargent, general manager of the New York & New Jersey Telephone Company, said:

In the first place, I might say that the company is not under the jurisdiction of the local authorities. The company was given a charter by the State authorities. The subway commission is the body from whom we obtain permission to extend our lines, which is a State body, appointed under a law passed in the legislature of 1885. Of course, the commissioner of city works is directly under the board of aldermen, and, no doubt, must abide by its resolutions. In this way our business can be somewhat delayed, for we are obliged to obtain a permit from the department before making any improvement or extension. If we are interfered with we will seek an injunction restraining the department of city works from blocking our business in any way. This same thing was tried about three years ago, at which time we secured a preliminary injunction.

Is There a United States Agent for the Britannia Oil Engine?

To the Editor of Electrical Review:

In your issue of February 20, 1895, I saw mentioned the Britannia oil engine, made by the Britannia Company, of Colchester, England. Would you please inform me if there is an agent for them in the States?

Yours truly,

Chas. H. Minchew.

12 W. Britannia St., Taunton, Mass., March 20, 1895.

The Telephone Hearing at Albany.

The Telephone Rate Reduction bill was taken up by the Senate Cities Committee, at Albany, N. Y., on March 19. John G. Milburn, of Buffalo, in behalf of the telephone companies, argued against the revised bill and said that it was the same plausible, adroit measure as before and just as oppressive. The proposed flat rates fixed by the bill were absurdly low and ruinous. It might be supposed that these rates had some rational basis, but they had not, any more than had the rates in the original bill, which were confessedly erroneous. He gave figures to prove that the actual cost of running each telephone in Buffalo was $75, yet it was now proposed to fix a rate for Buffalo of $48. Referring to Baltimore, population 400,000, he said the legislature fixed a flat rate at $78, and the telephone company rendered a service as best it could. Then the movers for reduced rates willingly asked to amend the bill, and now the rate is $120. In Indiana a bill was passed fixing a flat rate for $36, but after a short experience there was a public outcry for a repeal of the oppressive legislation, and it was repealed. Mr. John A. Delehanty, for the Hudson River Telephone Company, Mr. Jackson Wallace, for the New York & New Jersey Telephone Company, and Mr. Brandagee, for the Central New York Telegraph & Telephone Company, argued against the bill on similar grounds. An adjournment was taken for two weeks, when the hearing will be closed.

LITERARY.

A talk with the author of "Trilby," Mr. George Du Maurier, reported by Robert Sherard in *McClure's Magazine* for April, tells as good a story, with as charming a candor and cordiality, as "Trilby" itself.

Mr. Edward Atkinson has written for the April number of *The Forum* an article of unusual economic interest on "The Battle of Standards and the Fall of Prices," showing why prices have declined and on what articles.

Maxim, the much-talked-of inventor of flying machines and automatic machine guns, is presented in a new light in *Cassier's Magazine* for April, an excellent portrait of him being used as a frontispiece and a mass of new illustrations of some of his many inventions being given. The author of the article, J. Bucknall Smith, through an intimate acquaintance with Mr. Maxim, has had exceptional facilities for the collection of data concerning him, and touches upon many points in his career which have hitherto been known to but a few.

"Street Railway Review" In New Quarters.

Our Chicago contemporary, the *Street Railway Review*, whose offices were burned out on March 10, is now located on the seventh floor of the Old Colony Building, Chicago, pending the fitting up of its new offices on the eighth floor of that building, where it will locate permanently.

The Business Situation.

The advance in the prices of products has given the industrial world a sensation this week that has been foreign to it for a long time. We have arrived at a point, temporarily at least, where men have lost money by delaying purchases and nothing is more potent in changing sentiment.

It has been the conservative rule to carry unusually light stocks because of fears both as to consumption and prices. But as business actively increases, which means larger profits and a larger aggregate of wages, the demand for commodities may be temporarily, at least, beyond what is now anticipated.

The movement of money as shown by clearing house exchanges and the higher rates of interest proves the improvement a fact and not a theory.

The world is on hard pan as regards values, and at no time in our history have business principles been so strictly enforced.

We should not forget that actual wealth has increased through economies, and that, so sure as morning follows night, expansion will follow the contraction of the past.—*Boston News Bureau.*

The "Chuck" Carbon Holder.

The arc lamp carbon holder illustrated herewith and just put on the market by the Arc Light Supply Company, of Elizabeth, N. J., is something novel in the carbon holder line.

It is universal, taking a carbon from one-quarter inch to five-eighths inch diameter and it will fit any make of lamp. It is simple, strong, durable and strictly interchangeable. The clamping screw being one-half inch diameter does away with all liability of twisting or breaking off of clamping screw, a trouble common to

THE "CHUCK" CARBON HOLDER.—(Full Size.)

all carbon holders heretofore made. It is self-cleaning, and always brings the carbons in line with the rack of the lamp.

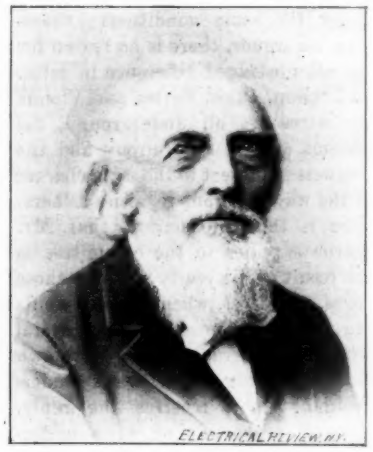
It is a carbon holder that will pay manufacturers of arc lamps to buy, as it will be sold in quantities cheaper than they would be able to turn out one of their own. Full information regarding the "Chuck" carbon holder may be had on application to the above-named company.

The Municipality and County, of Buffalo, N. Y., is a monthly publication which contains interesting matter relating to subjects indicated by its title.

DEATH OF PROF. P. H. VANDER WEYDE.

HIS LAST MANUSCRIPT.

Prof. Peter H. Vander Weyde, a scientist widely known among all technical men, died at his home in Clinton Place, New York city, on March 18 at the advanced age of 82 years. Professor Vander Weyde was born in Nymegen, Holland, in 1813. He was a descendant of Walter Vander Vogel Weyde, a troubadour of the fourteenth century. Another ancestor was Roger Vander Weyde, the



PROF. PETER H. VANDER WEYDE.

Dutch painter. He studied at Durpldorf, and graduated from the Royal Academy at Delft. He was a scientific writer and teacher in Holland, and professor of mathematics and natural philosophy at the Government School of Design. In 1849 he came to New York; he studied and graduated from the New York University Medical College in 1856, and practiced medicine until 1859. In that year he was appointed professor of physics, chemistry and higher mathematics at the Cooper Institute. He was also professor of chemistry in the New York Medical College. In 1864 the chair of industrial science was created for him at Girard College, Philadelphia. He resigned this professorship a few years later, and, returning to New York, became editor of the *Manufacturer and Builder*. Professor Vander Weyde's wife died about a year ago. He left several children, one of his sons being a prominent photographer in London. Of late years Professor Vander Weyde has done little active work except the preparation of occasional contributions to the technical press. He has written many articles for the ELECTRICAL REVIEW, and only a few days before his death was at work in the ELECTRICAL REVIEW office on what proved to be the last manuscript he was to write.

This is a continuation of Professor Vander Weyde's article on "What Is Electricity?" which appeared on page 322 of the ELECTRICAL REVIEW for December 26, 1894. The incomplete manuscript follows:

Notwithstanding some eminent men, such as Maxwell and Heinrich Herz, have applied mathematics to the explanation of electric phenomena, on the basis of the theory teaching the existence of a special imponderable fluid as the primary cause, this latter idea finds no favor in the minds of leading electricians, practical as well as theoretical, many of whom have assured me that they cannot accept the existence of a separate electric fluid.

At a meeting of the American Association for the Advancement of Science held in Washington a few years ago, one of the younger members came to me in high glee stating that at a meeting of one of the sections which he had attended that morning it had been fully explained what electricity is, namely, the interplanetary ether which fills the celestial space. I answered him that to my mind this was no explanation but only an assertion, and I asked him if it was explained how this ether came down from this celestial interplanetary space toward the cat's back as soon as the fur was rubbed. This acted rather as a damper on his enthusiasm.

That mathematics in this case cannot be of any avail to reveal the nature of what we are searching for was forcibly expressed by Huxley when he said that "the mathematical mill, though a very good mill, cannot make wholesome flour without good wheat," meaning by this that the basis to which we are going to apply mathematics must be sound and have a tangible reality, which is only found in matter.

It appears from the study of the different phenomena that the atoms and aggregations of atoms (molecules) manifest various qualities, such as cohesion, without being in actual contact, but manifest motions of different kinds which, by reason of their infinitesimal smallness, can never be seen by our ordinary senses, but their actuality may be demonstrated by results in changing the apparent nature of the matter.

These atomic and molecular motions may be oscillatory, vibrating, rotating and in orbits, as is the case with gases and vapors. . . .

"A Wheel in the Middle of a Wheel."

At the annual meeting of the American Association of General Passenger and Ticket Agents, held in New York city last week, Mr. George H. Daniels, general passenger agent of the New York Central & Hudson River Railroad, in delivering the annual address, took for his topic, "A Wheel in the Middle of a Wheel," Ezekiel i., 16. He said in part:

The lightning Ezekiel saw in his vision was the symbol of the power that enables us to read to-morrow morning, as we sip our coffee, the speech delivered in the English House of Commons after midnight to-night. "The living creatures ran and returned as the appearance of a flash of lightning." This means the fast flying trains, bearing the commerce of a nation, going over a mountain here, through the mountain there, in and out, with almost the rapidity of the lightning.

The lightning is the electric telegraph that circles the earth and takes a message of good or ill to the uttermost parts of the world, under thousands of miles of ocean, through trackless forests, across sandy deserts, where no human being can long exist.

Railroad strikes, like railroad wars of passenger rates, are of no benefit except to a few labor agitators in the one case and a few ticket scalpers in the other. They both result in loss to the strikers, the railroads and the public at large.

THE TELEPHONE CONTROVERSY IN NEW YORK STATE.

A SUMMARY OF AN INTERESTING LEGISLATIVE CONTEST.

The proposed bill to regulate the business of the telephone companies of New York State reached the fourth hearing in committee last week. Another hearing will be held next week for further ventilation of this important subject. A brief history of this controversy will be of interest to many of our readers. At the first hearing the author and chief supporter of the bill, Mr. Simon Sterne, of New York, argued in favor of its passage, basing his argument almost entirely on comparisons between telephone rates and practice here and in Europe, and on garbled deductions from that interesting work of fiction called the Ainsworth report. At the second hearing General Tracy and Mr. John Milburn criticised the bill in detail, and showed it to be a bad piece of work all through. An abstract of General Tracy's argument was published in the ELECTRICAL REVIEW for March 13, 1895. Mr. Sterne asked for an adjournment, that he might have time to provide amendments to meet the criticisms and objections made. At the third hearing Mr. Sterne presented his amended bill, which differed widely from the original measure—to the extent, as the counsel of one of the telephone companies said, of containing no less than 68 amendments—and supported it by an argument containing a fresh batch of misstatements of the most glaring kind relating to foreign telephone matters.

At the fourth hearing some of the telephone counsel were heard in opposition to the amended bill and an adjournment was taken to give the rest a chance to be heard.

As to the bill itself it may briefly be described as a measure to impose on a commission composed of the Comptroller, the Attorney-General and the State Engineer the duty of fixing the charges of every telephone company in the State of New York. That is what it practically amounts to, because, although the bill purports to fix the rates, the amounts named are, according to counsel for the telephone companies, in all cases below the actual operating expenses of the companies to which they apply; therefore, every company would have to ask for a rate to be fixed after investigation by the Comptroller, the Attorney-General and the State Engineer, which officers are named in the bill for that purpose. It is quite in the order of things that such an unpractical and unprecedented measure as this should be supported by arguments teeming with erroneous and inaccurate statements. The bill itself displays utter ignorance of well-recognized features of the telephone business in this country, and the arguments made by Mr. Sterne show a similar state of mind as regards telephone matters abroad. That, in spite of his boasted study of telephone matters in Europe—study undertaken during yearly trips to Europe for the past five or six years—he should supply the committee with such gross misinformation argues very badly for Mr. Sterne's capacity for assimilating and retaining information.

Mr. Sterne's principal assertions regarding European telephone service are, that although it is furnished at lower prices than telephone service in New York, the business is conducted under the same conditions; therefore, he argues, there is no reason for the acknowledged difference in rates. In London, Paris, Berlin and Vienna the wires are all underground, the systems are metallic circuit and the business is subject to the same charges in the way of patent royalties as here. This is the information that Mr. Sterne supplies to the committee as the result of his yearly visits to those cities. And yet, when his statements are called in question by General Tracy, he telegraphs to his brother in London asking "Are wires underground?" and receives the reply, "Small proportion of wires underground." Small wonder that Mr. Sterne admitted that he felt doubtful about the correctness of his own information.

As a matter of fact, Paris is the only European city having a comprehensive underground system, and there the cables are placed in the sewers, which, in reality, are tunnels under every street admirably adapted for the accommodation of electric wires, at no expense to the administration. The sewer system, however, is bounded by the fortifications, which enclose an area of the city almost circular and about five miles in diameter. Outside the fortifications the wires are overhead, and telephone subscribers in this part of Paris have to pay not only the first cost of establishing the overhead portion of their lines, but also an extra yearly rate for maintenance. Moreover, all the telephone subscribers in France have to buy and maintain their own instruments.

In Berlin, as we stated in a previous article, only a small proportion of the wires are underground, and in Vienna, although the proportion is larger, every street is festooned with aerial wires, and every square and open place is ornamented with iron distributing towers. London and Berlin are grounded circuit systems, Vienna is a mixed system, and Paris alone is on an exclusive metallic circuit basis. In Germany and France there have never been any fundamental telephone patents, and in England and Austria they have long ago expired. These are all facts that any technical man who has visited Europe and is a reader of the European technical journals is familiar with, and they are facts entirely at variance with the statements made by Mr. Sterne in support of the telephone bill.

In his last speech, reported in the New York *Times* of March 6, Mr. Sterne went even further astray than on any previous occasion. In endeavoring to contradict General Tracy's remarks on the London rate he said that in London there are 600 exchanges and 35,000 subscribers in an area of 730 square miles, and that scarcely any man could be more than a mile from an exchange, and so subject to the mileage charge of £2 10*s.* per half mile. Certainly none of Mr. Sterne's opponents could have knocked the bottom out of his pretended familiarity with foreign telephone affairs more effectively than Mr. Sterne did himself in making this egregious error—an error, by the way, on which he based the principal part of his last argument. What Mr. Sterne did is very obvious. He took the report of the National Telephone Company, and collected all their exchanges and all their subscribers scattered throughout the United Kingdom and transported them without a moment's hesitation to London. Having got them there, he "confronted" the Metropolitan company with a system of 35,000 subscribers at a rate of $100, and stormed and raved over that gigantic system to his heart's content. The real figures of the London system are between 7,000 and 8,000 subscribers and 32 exchanges. As the area which these 32 central offices serve is 730 square miles, it is plain that many subscribers must have lines longer than one mile, and that, as General Tracy contended, the nominal rate does not represent the actual average rate.

We have no doubt that the telephone companies are more fully informed on all these points than we are and have ample information of an official character with which to correctly instruct the committee on all the points on which it has been misinformed by Mr. Sterne. Some of his statements are so obviously untrue that they carry contradiction on the face of them. For instance, in the *Times* report already referred to he says that in London unlimited telephone service over the London-Paris line is supplied for $200 a year. As the charge for a three minutes' connection is $2, it is manifestly impossible that unlimited service can be supplied for a yearly rate equal to the price of 100 connections. The $200 charge is for the rental of a special metallic circuit line and instruments to enable direct long-distance communication from the subscriber's house or office—a facility that every metallic circuit subscriber in New York has—without the necessity of a second line and a second annual rate.

There are two points that particularly strike an observer of this controversy who is at all familiar with the subject under discussion. One is that any weight or importance at all can attach to the arguments of a man so apparently ignorant of the facts as Mr. Sterne has shown himself to be. If his perorations were addressed to a committee of technical men he would simply be laughed out of court. And right here let us say that, if any scheme for regulating the telephone service of New York city originating from such ignorant sources as the present one were to become a law the business men who use the service would demand the repeal of that law as unanimously and as promptly as did those of Indianapolis under similar circumstances a few years ago. The telephone service has become an integral and vital part of the city's business machinery. Its cost is insignificant compared with the duties it performs. Cut the rate in half and you must inevitably divide its efficiency by two—or perhaps by 10, for technical industries are not amenable to simple rules. The effect which such an interference would have on the affairs of those who have organized their business methods in accordance with the assistance rendered by the present high grade telephone service is not to be estimated. The language of the Committee of Seventy would be mild and feeble compared with the protest that the business community would raise.

The second observation we have to make is that, even if all the facts were correctly stated, there is no fair comparison to be made between American and European telephone rates. A proper statement of all the facts would amply demonstrate this by illustrating the widely different conditions that obtain, both in the cost of operation and in the class of service furnished. It is notorious that the continental systems are operated at a loss, and that, as is the case with the telegraphs in England, the taxpayers' money makes up the deficit.

The Use of Mica in Place of Selenite.

To the Editor of Electrical Review:

Noting a few lines on page 143 of your issue of to-day, let me say that my son has been using mica plates in his microscope, in place of selenite, for some time, and finds it quite satisfactory, though it does not give as brilliant color effects as the selenite. It first attracted his attention because of the ease with which it could be split into very thin layers and did not require polishing as would the selenite. One very interesting polarization object he has is cadmium bromide; interesting because of its instability, as on each examination it appears with different crystals than those seen at the last, and a slight warming over a lamp will change the crystallization so that the growth of the crystals may be watched. Yours,

CHAS. J. BATES.

New York, March 20, 1895.

KIND WORDS.

FROM A BOSTON OBSERVER.

To the Editor of Electrical Review:

Your last issue contained a very creditable extra. I wonder who wrote it, and shall be glad to know the intrepid author. I also note that your brother, *The Electrical Engineer*, received a patting on the wrong side of the back. Your other contemporary, the green and "wounded" one, seems to have drawn the *toga virilis* over his head and is contemplating the fall of Jerusalem. M. N. V.

Boston, March 22, 1895.

EXHIBITION OF STANLEY APPARATUS.

TWO-PHASE ALTERNATING CURRENT SYSTEM SHOWN AT THE CITIZENS' ELECTRIC ILLUMINATING COMPANY'S PLANT IN BROOKLYN.

An interesting exhibition of the Stanley Electric Manufacturing Company's two-phase alternating current system, by which light and power can be supplied from the same generator and circuit, was given at the station of the Citizens' Electric Illuminating Company, in Brooklyn, N. Y., on Friday evening, March 22, from eight to ten o'clock.

The Citizens' company has in contemplation the addition of a complete system of incandescent lighting and had on exhibition a Stanley two-phase alternating system, showing arc lights, incandescent lights and motors on the same circuit and dynamo. Up to a recent date the company has been handicapped by the Edison incandescent lamp patent. By the Bate decision the field has been opened to competition, and it is the intention of the Citizens' company to take advantage of the fact and offer to the public a safe and efficient service at reasonable rates. A large number of people, including prominent electricians, officials of the Edison Electric Illuminating Company of Brooklyn, electric light men from New York, electrical newspaper men and others, were present. The genial president of the company, Mr. Bernard Gallagher, and General Superintendent E. F. Peck, gave the guests a warm welcome.

The plant of the Citizens' Electric Illuminating Company, located at DeKalb avenue and Rockwell place, comprises two distinct buildings. Nos. 6 and 8 Rockwell place, or what is known as the old station, is a two-story brick building, 75x100, equipped with three engines, aggregating 1,100 horse-power, which are connected by means of jack and countershaft to thirty-nine 45-light Thomson-Houston arc dynamos, with a total capacity of 1,755 arc lights of 1,200 candle-power each. The new plant, Nos. 10, 12 and 14 Rockwell place, is a three-story brick and iron building, 75x100 feet, equipped with two vertical triple-expansion condensing engines of a capacity of 400 horse-power each, belted direct to two lines of shafting on the dynamo room floor, to which are belted 28 Thomson-Houston 45-light arc dynamos. The steam plant is composed of nine boilers, with a capacity of 150 horse-power each, and six water-tube boilers of a maximum capacity of 250 horse-power each. Feed pumps and condensers are of the duplex type, and the feed-water heaters are of the Goubert manufacture.

The water for condensing and other purposes is obtained from a system of driven wells with a guaranteed capacity of 2,000 gallons per minute. One of the features of the station is a fire-proof switchboard, probably the largest in the country, which handles 96 circuits and 72 dynamos, allowing the connecting or disconnecting of any dynamos or circuits. The offices, stock room and testing departments on the third floor are handsomely furnished and well equipped.

ELECTRIC RAILWAY NOTES.

Officers of electric railway companies are requested to send promptly to the ELECTRICAL REVIEW *notices of meetings, election of officers, declarations of dividends, financial reports and all items of interest in connection with the financial and practical operation of their roads.*

The electric railway between Johnstown and Gloversville, N. Y., is now in operation.

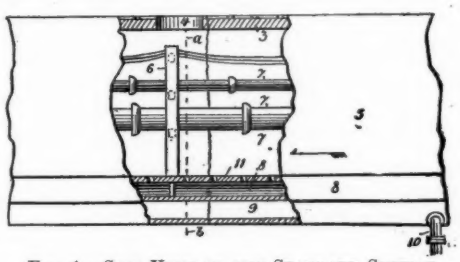


FIG. 1.—SIDE VIEW OF THE STANDARD SUBWAY.

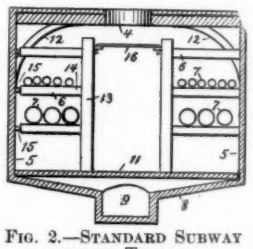


FIG. 2.—STANDARD SUBWAY WITHOUT TROLLEY.

The Schuylkill Valley Traction Company has bought the Tumbling Run, Pa., Hotel for $35,000.

Mayor Schieren, of Brooklyn, N. Y., was in Philadelphia last week inspecting that city's trolley systems.

John R. Stirling has resigned his position as secretary of the Citizens' Street Railway Company, of Detroit, Mich.

It is claimed that the Philadelphia Traction Company is negotiating for the control of all the trolley lines in Harrisburg, Pa.

The Hingham, Mass., Street Railway Company has received authority to increase its capital stock $55,000, making the total capital $100,000.

A gigantic street railway deal is said to be under way, by the consummation of which the Broadway Cable Company, of New York, the Consolidated Traction Company, of New Jersey, and the Philadelphia Traction Company are to be united.

A company has been organized to build an electric road from Turner's Falls, Mass., to Lake Pleasant and Miller's Falls, a distance of five miles, at a cost estimated at $80,000. The capital stock of $40,000 is pledged. Work will be commenced as soon as a franchise is granted.

The Atlanta Consolidated Street Railway Company is preparing plans for handling the large attendance which is expected at the Cotton States and International Exposition,

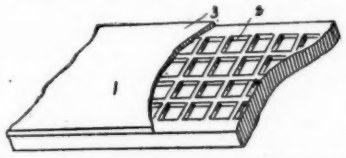


FIG. 3.—SURFACE PLATE FOR STANDARD SUBWAY.

which will be held at Atlanta, Ga., next fall. The officers of the Consolidated company are Joel Hurt, president; Ernest Woodruff, vice-president and general manager, and H. N. Hurt, superintendent. The board of directors is formed by Joel Hurt, R. J. Lowry, S. M. Inman, W. C. Sanders, E. Woodruff, Henry Jackson, H. E. W. Palmer, H. A. Inman, J. C. Payne, J. T. Dargan and J. H. Watson.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

DR. LOUIS DUNCAN NOMINATED FOR PRESIDENT.

At the regular monthly meeting of the Institute council, held March 20, 20 associate members were elected and three associates were transferred to full membership. As required by the rules of the Institute, the council canvassed the nominating papers received from the membership and prepared the following ticket:

For president, Dr. Louis Duncan, of Baltimore; for vice-presidents, Dr. M. I. Pupin, of New York city; W. F. C. Hassen, of San Francisco, Cal.; Angus S. Hibbard, of Chicago; for managers, Carl Hering, of Philadelphia; Bion J. Arnold, of Chicago; Charles F. Scott, of Pittsburgh; Dr. Cary T. Hutchinson, of New York city; for treasurer, George M. Phelps, of New York city.

Three vice-presidents and managers hold over by the rules as follows: Vice-presidents, Prof. W. A. Anthony, Prof. Francis B. Crocker and James Hamblet, of New York; managers, Prof. Harris J. Ryan, of Ithaca, N. Y.; Chas. Hewitt, of Philadelphia; J. J. Carty and W. J. Hammer, of New York; A. E. Kennelly, of Philadelphia, and W. D. Weaver, Chas. S. Bradley and W. B. Vansize, of New York.

At the meeting of the Institute at 12 West Thirty-first street, in the evening, 80 members and guests were present. A paper on "A Method for Preventing Armature Reaction," by Prof. H. J. Ryan and Milton E. Thompson was read by the former. The discussion was participated in by Townsend Wolcott, W. L. Bliss, E. A. Merrill, Dr. C. T. Hutchinson, C. S. Bradley, C. O. Mailloux, Dr. C. E. Emery, A. E. Kennelly, G. S. Dunn and Maxwell M. Mayer.

The "Standard" Municipal Conduit and Subway.

Mr. Samuel Goldberg, of Detroit, Mich., is the inventor of the "Standard" municipal conduit and subway system shown in the accompanying illustrations. The purpose of the conduit and subway is to hold electric wires, gas, water and all other pipes, in such a convenient manner as to be accessible at all times in case of necessary repairs or relaying.

The subway is rectangular in its section, the materials of construction being as circumstances may dictate. Fig. 1 represents the interior as would be seen if a portion of the side wall were broken away. The racks, 13, are shown supporting systems of piping and wires. Fig. 2 is an end view of the same structure upon the dotted line *a*, *b*. By following the figures or numerals, it will be understood that 3 is the surface plate, 4 a manhole therein, 5 the side walls, 6 cross bars of racks upon which rest pipe lines 7; that 8 is a transversely sloping main floor, 9 a longitudinal trough or channel which carries waste water to a sewer outlet 10; 11 is a grate floor or floor proper; 12, 12 are braces to the surface plate; 13 are stanchions to which bar 6 is fastened, which latter are fastened at their other end by pivots 15 to the side walls of the subway.

Fig. 3 is an enlarged section of the surface plate 3, in the upper part of which are a series of recesses or honey combs 2, having for their purpose the receiving and holding the cement street paving 1.

Fig. 4 represents an improved form of the subway, having a more extensive engineering scope. Thus, yoke 25 is so made as to support far greater weights, and the structure 17, 18, upon which are placed longitudinal I beams 19 and 20, is made with the same view. The beam 20 carries an electric wire for the underground trolley system.

The purpose of the invention throughout is to provide a structure that can be manufactured at the works in section and assembled at the desired point. The interior arrangement is purposed to be entirely convenient and at the same time simple.

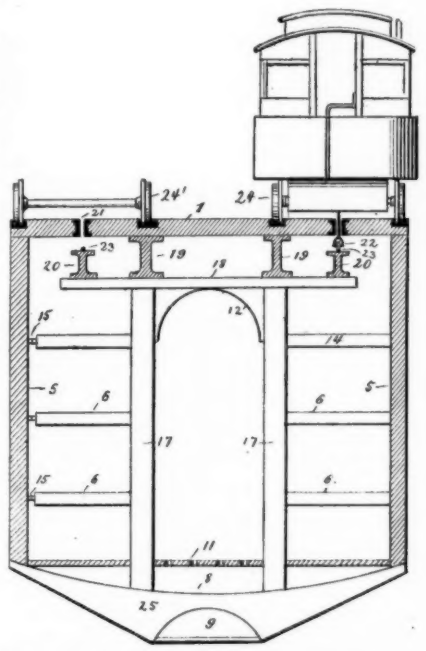


FIG. 4.—STANDARD SUBWAY AND UNDERGROUND TROLLEY.

While it is true that subways for the large cities are not, by any means, a new engineering thought, it is claimed for the Goldberg invention that it brings together every desirable feature and dispenses with those that are of no value. The scheme for making the surface plate anchor the street cement or asphalt paving material is at once unique and practical. The drainage system for the subway, one of the greatest problems in such structures, is claimed to be perfect; moreover, in extra cases, the outflow of the drain can be valved to prevent backwater, something desirable where there is a bare electric wire for the trolley car.

NOTES ON RECENT ELECTRICAL ENGINEERING DEVELOPMENTS IN FRANCE AND ENGLAND.

READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK AND CHICAGO, FEBRUARY 27, 1895, BY H. WARD LEONARD.

(Continued from page 154.)

LIVERPOOL ELECTRIC RAILWAY.

At Liverpool I investigated the overhead electric railway. The overhead structure, the motors, methods of collecting the current, etc., were exceedingly well designed and constructed, and gave evidence of good working. The central station apparatus and design was not, however, up to the standard of work here in recent electric railways.

The series parallel control is used, but no rheostat, the designer seeming to realize that it might just as well be left out and equivalent resistance secured in the windings of the motors themselves, with less apparatus and no appreciable difference in economy or control.

ENGLISH CENTRAL STATIONS.

In London I visited several central stations, of which I will mention two. The first is that of the Metropolitan Electrical Supply Company. This company has an enormous area allotted to it. I will explain right here, that both in London and Paris the authorities follow the plan of granting to several different central station companies—supply companies as they term them—the exclusive right to a certain section of the city. No such company can run into any other company's section. At the central station of the Metropolitan company, I found four Parsons steam turbine units of 350 kilowatts each, running at 3,000 revolutions per minute. These steam turbines had been in operation only a short time when I saw them, and had been installed for the reason that the central station had been enjoined by the courts from operating the reciprocating engines formerly in use because of the vibration they caused. I was informed that the vibration was particularly troublesome and difficult to overcome, because the central station was built upon made land, above the bed of a former river, and that the ground was boggy and transmitted any vibration in the most surprising manner. I inquired as to the working of the steam turbines and was informed that they were not able to detect any difference in their coal consumption compared with the compound condensing reciprocating engines formerly in use. I found that an accident had happened to one of the steam turbines by which it had lost all of the blades in one of the three chambers, which reduced its capacity and efficiency considerably, but did not put it out of service entirely.

The other London central station I shall refer to is that of the City of London Company. This company supplies the heart of London, that is the old "City of London," which is without doubt the best central station territory in the world, on account of the wealthy nature of the customers, the substantial character of the buildings, and especially because of the peculiarly dismal foggy weather in London. While I was there artificial light was required almost as much by day as by night. This central station is beautifully located on the south bank of the Thames, near the center of lighting, and is a fine example of the best that can be done to-day with the alternating system under such conditions. I do not believe it would be possible to find less excuse for the use of the alternating system than in this station, and yet I expect it will pay, for it can hardly fail to earn money under such extraordinarily favorable conditions for lighting.

But I need hardly say that they have no motors except toys, and but few of them; and when I remember that in Chicago 40 per cent of the connecting load is motors and that this percentage is rising all the time, it seems evident that the City of London Company is terribly handicapped by the use of the alternating current. However, they have a 2,000-volt three-wire secondary, and operate the dynamos all on multiple arc, which is certainly using the alternating current to the best advantage. Aside from the use of the alternating current under these conditions, it is difficult to say anything in criticism of the central station.

The plant is arranged on the panel system, which Mr. Mordey says originated with him, and which is thoroughly carried out in this station, for each panel or section across the building comprises an independent unit, including a boiler, engine, dynamo and switchboard for 500 kilowatts. The engines are vertical and direct coupled to the Mordey alternators. The switchboards are entirely novel in design, being cast-iron pyramids about 10 feet high, standing clear from the wall and having all of the conductors inside, with the instruments, etc., mounted on the front face. While very finely finished and ornamental, I could not but think that the vital parts would be more difficult to inspect and repair, in case of emergency, than in our recent switchboard practice.

One detail of electrical construction in which the foreign practice seems very backward is the rheostats. In this magnificent station in the city of London, for instance, and in many other places, I saw rheostats made by winding german silver wire on a slab of slate, which was then mounted on insulators horizontally on a table, and a slider arranged to move over the surface of the resistance wire itself, which was thoroughly exposed.

Another detail in which we are certainly in advance of foreign practice is our instrument work, for which we must thank Mr. Weston solely. I saw many fine instruments while abroad, but they seemed to be more suited for a physical laboratory than a central station. The substantial, compact, permanent features of the Weston instrument, with its readable scale and dead beat index, were conspicuous to me by their absence.

FRENCH CENTRAL STATIONS.

In France the most interesting central station I saw was in Paris where I visited a sub-station designed for a capacity of 30,000 lights. The sub-station was supplied from a distant central station by means of a constant current of 250 amperes, all devices on this current being in series and the total electro-motive force running as high as 6,000 volts at times.

In the sub-station were rotary transformers, the primary ends of which were series wound motors and all being in series. The secondaries of these rotary transformers as generators fed a five-wire system of conductors, and in multiple arc with these generators across the five-wire system was a bank of storage batteries. The lamps used were 110 volts; some of the rotary transformers had 110-volt secondaries, four of such secondaries being in series so as to make the five-wire system complete independently of the batteries. Others of the rotary transformers had 440-volt secondaries and fed the outside conductors only. On each rotary transformer was a rheostat which was in multiple with the series-wound field and which by a step-by-step movement, similar to that of the old United States automatic regulator, controlled the strength of the series field so as to keep the electro-motive force in the secondary constant, the controlling magnet of the automatic being across the secondary of constant electro-motive force.

The storage battery plant was well designed and seemed to be in good order. It was as clumsy and seemed as full of troublesome possibilities as those we have on this side of the water. It had capacity for 8,000 ten candle-power lamps for three hours and cost about $30,000, weighed about 400,000 pounds and occupied a space about 32x50 feet. This cost means about $107 per kilowatt of output, which seems a pretty high price to pay for a plant to generate electrical energy to-day, especially when it probably has an efficiency at three hours' discharge not above 60 per cent. Such a storage battery must be compared in cost with the cost of boilers, engines and dynamos per kilowatt, which would cost perhaps $50 per kilowatt, and whose efficiency would be 100 per cent as compared with the 60 per cent efficiency of the storage battery, since the storage battery must derive its energy from a steam plant first. The craze for storage batteries as the universal panacea for electrical troubles, which we have all read so much about in connection with European practice, seems to be on the wane, if I may judge from the statements of the engineers, rather than the storage battery manufacturers; but when we remember that in France and England they do not know what a healthy motor load means, we need not be surprised at the claims of inefficiency for stations which do not use batteries, and hence run their boiler, engine and dynamo for most of the 24 hours practically without load.

IMPORTANCE OF THE LOAD FACTOR IN CENTRAL STATIONS.

All central station people have known for years that the most profitable consumers were those who used their lamps for the greatest number of hours.

In other words, that the net profit due to a consumer was largely dependent upon the relation between his average load and his maximum load, which Mr. Crompton in England has aptly called the "load factor." Yet, while appreciating this fact, central station companies make their rates dependent upon the kilowatt hours used, and independent of the maximum kilowatts used.

Mr. Arthur Wright, at Brighton, in England, deserves the credit, as far as I know, for having first given commercial recognition to this load factor of the consumer. Mr. Wright supplies each consumer not only with a meter which registers the kilowatt hours used, but also a second meter of simple construction which registers the maximum kilowatts used at any time during the month, and the discount which the consumer gets is very largely due to the relation between his average and his maximum kilowatts.

Suppose that there are two customers connected to a central station and that the monthly readings show that each has used 900-kilowatt hours. By the usual practice in this country the bill would be the same, yet one bill may be due to the use of one and one-quarter kilowatts for 24 hours per day, and for 30 days per month, and the second bill may be due to the use of 30 kilowatts, an average of one hour per day for 30 days per month. That is, the first bill may be due to a steady load, such as a few lamps in a basement of a hotel or a ventilating fan, while the second bill may be due to a larger load of lamps used only occasionally, as in an office building, or an electric elevator requiring 30 kilowatts for a few seconds to start it up and after starting requiring only 15 kilowatts.

With the same 900-kilowatt hours per month for the two cases, the central station company should charge at least five times as much for the case having the elevator and small load factor as in the other case.

It is a fact not generally appreciated that in any central station the cost of producing a kilowatt hour can be divided into two portions, one of which, such as interest on cost, depreciation, salaries, a small part of the labor and coal vary with the kilowatt capacity of the plant, that is proportionately to the maximum load, and are independent of the number of kilowatt hours produced, and the other portion of the cost of producing one kilowatt hour represented by the larger portion of the coal, labor, water, etc., is dependent upon the number of kilowatt hours produced and is independent of the maximum load.

The fact about this matter which is least appreciated is that the portion of the total cost of one kilowatt hour produced, which depends upon the maximum load, is about two-thirds of the total cost, and the part dependent upon the output is only about one-third.

In a modern central station one kilowatt of its capacity represents about $300 invested. Consider the two consumers cited above. Both loads are in use at the time of maximum daily load. For the elevator, the central station has to provide an investment of $3,000, for the ventilating fan $375. Assuming interest, depreciation and similar charges, at 10 per cent we have $900 to deduct from our gross earnings in the elevator case before we reach net profits, and $37.50 in the other case.

Suppose we get 10 cents per kilowatt hour in each case, and that the cost of production, independent of general expenses, interest depreciation, etc., is 50 per cent of the gross receipts, etc. This would mean that if we get 10 cents for each kilowatt hour in both cases, our gross revenue would be $90 per month in each case, and our gross profit $45 per month, or $540 per year in each case. But in the elevator case we have interest and depreciation charges of $900 a year, and hence have actually lost considerable money in supplying this customer, while in the other case we have made a net profit of over $500 per annum.

We would have to charge more than 10 times the rate per kilowatt hour to the elevator that we charge to the ventilating fan to make the same net profit on $1 of capital invested.

This load factor is a most vital question, and it is the difference in load factors in English and American central stations which makes storage batteries commercially possible there and impossible here.

The average load factor of an English central station is less than 15 per cent, and even in London in December it is only 33 per cent, while in most American cities the load factor which averages 40 per cent will in December in many cases be about 50 per cent.

This difference is due almost wholly to our motor load, which is an almost unknown quantity abroad. With a 15 per cent load factor a storage battery may pay, but not with a load factor of 40 per cent, especially when the load factor in our central stations is rising each year.

If central station companies would offer such a discount due to load factor

as to warrant an individual customer's installing at his own expense a storage plant which he would charge at the minimum rate per kilowatt hour by a steady current for 24 hours per day, and then used this stored energy to supply his occasional demands for an occasionally very large rate of energy, I believe it is possible that the central station companies, the storage battery companies and the consumers might all derive a profit from the arrangement. I have no doubt that a central station company could afford to make a rate of four cents per kilowatt hour for a continuous service night and day, and make a satisfactory profit, while it would surely lose money in supplying an elevator, such as described above, even at 15 cents per kilowatt hour.

I believe that the following schedule of rates fairly represents the charges per kilowatt hour that should be made to customers of various load factors:

Load Factor.	Rate per kilowatt hour in cents.	Resultant gross income per annum per kilowatt of plant.
5	20	$131.40
10	20	175.20
15	16	210.24
20	13	227.76
25	11.2	245.28
30	10	262.80
35	9.2	281.07
40	8.5	297.84
50	7	306.60
60	6	315.36
70	5.3	325.00
80	4.8	336.38
90	4.4	346.89
100	4	350.40

It must be noticed that this argument would lose most of its force if the maximum load of the consumer did not occur at the time of day when the maximum load was upon the central station; but in elevators and similar loads which call for their maximum load in starting up every few seconds, the maximum loads will not only occur together occasionally, but this will sometimes occur at the time of maximum load on the central station, and when this accumulated load is put upon the central station the kilowatts must be there to meet the demand.

ELECTRIC HEATING.

I saw evidences of a very healthy demand for electrically heated devices while abroad. In London the principal central station company is running at its own expense a show room for the education of the public in this line, and several manufacturers of electric heaters told me the demand was very satisfactory and promised a good future.

(To be continued.)

LETTERS FROM OUR FRIENDS.

"COULD NOT DO WITHOUT IT."

To the Editor of Electrical Review:

I hand you herewith the amount of my subscription to your paper for 1895. I am very much pleased with the Electrical Review and could not do without it. Also send $1.50 for "Telephone Lines and Their Properties," which please send as soon as possible.

Very truly yours,
L. A. H.

Freeport, March 15, 1895.

AN ENTHUSIASTIC TELEPHONE READER.

To the Editor of Electrical Review:

I enclose draft to balance my account. You have the only paper for the telephone fraternity.

A. G. S.

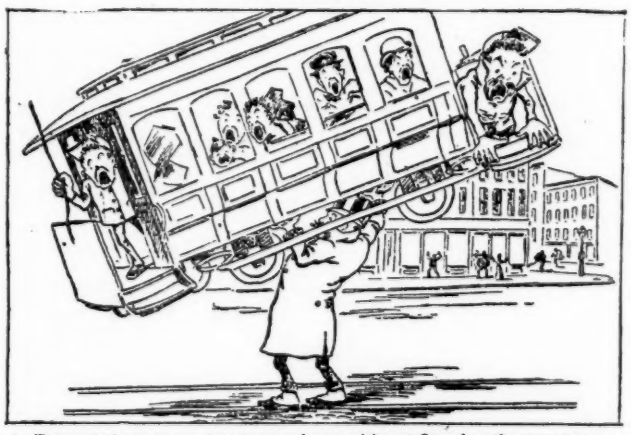
Red Oak, Ia., March 18, 1895.

THE MOTORMAN'S MISCALCULATION.

[*From the Boston Herald.*]

1. Motorman—Out of the way! out of the way! Can't stop! Fly for your life!

2. "See here, young man—



3 The next time you run into any one be sure it's not Siamdow the strong man.—

4. And mind you don't forget it'"

Wallace & Sons' Plant Reported Sold.

It was reported last Friday that W. A. Clark, a wealthy mine owner of Montana, had purchased for $1,000,000 the extensive wire mills of Wallace & Sons, at Ansonia, Conn. Mr. Thomas Wallace said that the report was premature. The plan proposed will make Mr. Clark the principal owner, with the Wallaces retained as the active management of the concern, and using the ores from Mr. Clark's mines.

Col. E. L. Babcock, of the Falls Rivet and Machine Company, Cuyahoga Falls, Ohio, was a visitor to New York last week.

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Made into any design for Electrical Trimmings, Push Buttons, Knobs, Handles, etc. Can be made to cost no more than other material.
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513 BROADWAY, NEW YORK.

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M. & B. TELEPHONE CO.,
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FACTS. Electrically-driven machinery is modern and proper.
Crocker-Wheeler apparatus is the best for this purpose, liberally proportioned, a generous factor of safety, and no trouble, if you allow us to advise you.
Crocker-Wheeler Electric Co.
Manufacturers and Electrical Engineers.
New York.
Chicago.
Boston.
Philadelphia.

KINDRED INTERESTS

The Electrical Supply house of Walker & Kepler, 531 Chestnut street, Philadelphia, have recently enlarged their quarters to meet the demands of increased business.

The Robb Engineering Company, Limited, of Amherst, Nova Scotia, Canada, have issued a very complete catalogue illustrating and describing the various types of Robb-Armstrong engines which they manufacture. The company has branch offices in Montreal, Toronto, Winnipeg and Vancouver.

The Globe Metal Works, of Newark, N. J., refiners of platinum and purchasers of scrap, have a very complete and interesting plant at 125 to 129 New Jersey Railroad avenue. This company will be glad to correspond with any one who desires to purchase platinum or who has scrap platinum for sale.

The Mather Electric Company, of Manchester, Conn., report the sale through Messrs. H. B. Coho & Company, of the *Mail and Express* Building, New York city, of one 250-light and one 350-light improved Mather ring type dynamos for the new lighting plant of the Portland Apartment House, Washington, D.C., Messrs. Coho & Company having been awarded the contract for the entire plant, including engines, piping, fittings, etc.

During the present month the Rice & Sargent Engine Company, of Providence, have received three orders for steam engines. One is a tandem-compound of 300 horse-power, with cylinders 14 and 26 inches and a 42-inch stroke, independent condenser, to run at 100 revolutions a minute in the Pembroke Mills, Suncook, N. H. The Lawrence, Mass., Lumber Company has ordered a 200 horse-power engine 20x42 80 revolutions, and the Oakdale Manufacturing Company, of Providence, a 75 horse-power engine, 12x30, 110 revolutions.

Metropolitan Electric Company, Chicago, have been appointed agents for the Solar arc lamps—a lamp of unusual merit for incandescent circuits. Its feed mechanism is so simple and adjustable that it has been found to be a most thoroughly economical and practical lamp. It is simple in construction, has a positive action of feed, no springs or dash pot, no see-sawing. The lamp is manufactured plain or in various styles of ornamentation to meet the requirements. Samples are being exhibited at the warerooms of the Metropolitan Electric Company, 186 and 188 Fifth avenue, Chicago, where they carry a stock for immediate shipment. Prices are made to suit the times.

The Village of Canandaigua, N.Y., has recently let the contract for the construction of a new waterworks system. The pumps will be operated by means of power electrically transmitted, on the three-phase system of the General Electric Company, which company will supply all the electrical apparatus. The power house will be located at the foot of Main street, in Canandaigua Lake, and will contain one 100-kilowatt three-phase generators delivering current at 2,030 volts. This will be driven by a steam engine. The current will be transmitted to the pumping station, 18,000 feet distant, on the shores of the lake, 3,500 feet from reservoir. The pump-house will be occupied by two 1,000,000-gallon pumps, directly geared to 100 horse-power induction motors, wound for 2,030 volts and revolving at 600 revolutions. The duplication of the pumping system has been determined upon in order that the work may be effected continually even should one pumping equipment break down. An automatic signal alarm will indicate at the power house when the reservoir is full.

The annual report of the New York & New England Railroad for the year ending December 31, 1894, has just been issued by the vice-president and directors, and is one of the most important in the history of the company, in view of the present reorganization proceedings. It is especially interesting from the fact that during the year a system of management entirely new to that property was introduced, and the result has already vindicated the judgment of those who, a few months ago, hopefully undertook the task of placing the road upon a paying basis. The financial statement of operations shows that, although there was a total decrease in gross earnings of $543,580, due to the general demoralization of business, there was an actual increase in net earnings of $1,984. This would be very satisfactory showing for a road in the hands of receivers, even if only the ordinary repairs and improvements had been made, but when it is understood that the sum of $308,604 was expended for improvements and extraordinary repairs and charged to the regular expense account, the result is seen to be a really remarkable one.

Receiver for the Long Island Traction Company.

Horace J. Morse, of A. M. Kidder & Company, 18 Wall street, New York city, was appointed receiver of the Long Island Traction Company on March 18 by the United States Circuit Court of Virginia, in which State the Traction company was incorporated. The Brooklyn Heights Railroad Company, of Brooklyn, N. Y., was owned by the Long Island Traction Company. The application for a receiver was made by Thomas Moore, the counsel of the company, and was endorsed by the committee of stockholders which was recently appointed to devise some plan to extricate the company from its financial difficulties. The committee expects to reorganize the company, and has asked the stockholders to contribute $2 per share in exchange for receiver's certificates, which will entitle them to participation in any benefits which may result from the reorganization.

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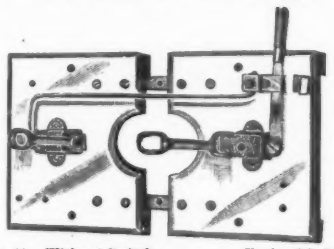
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